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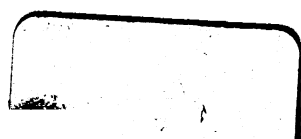
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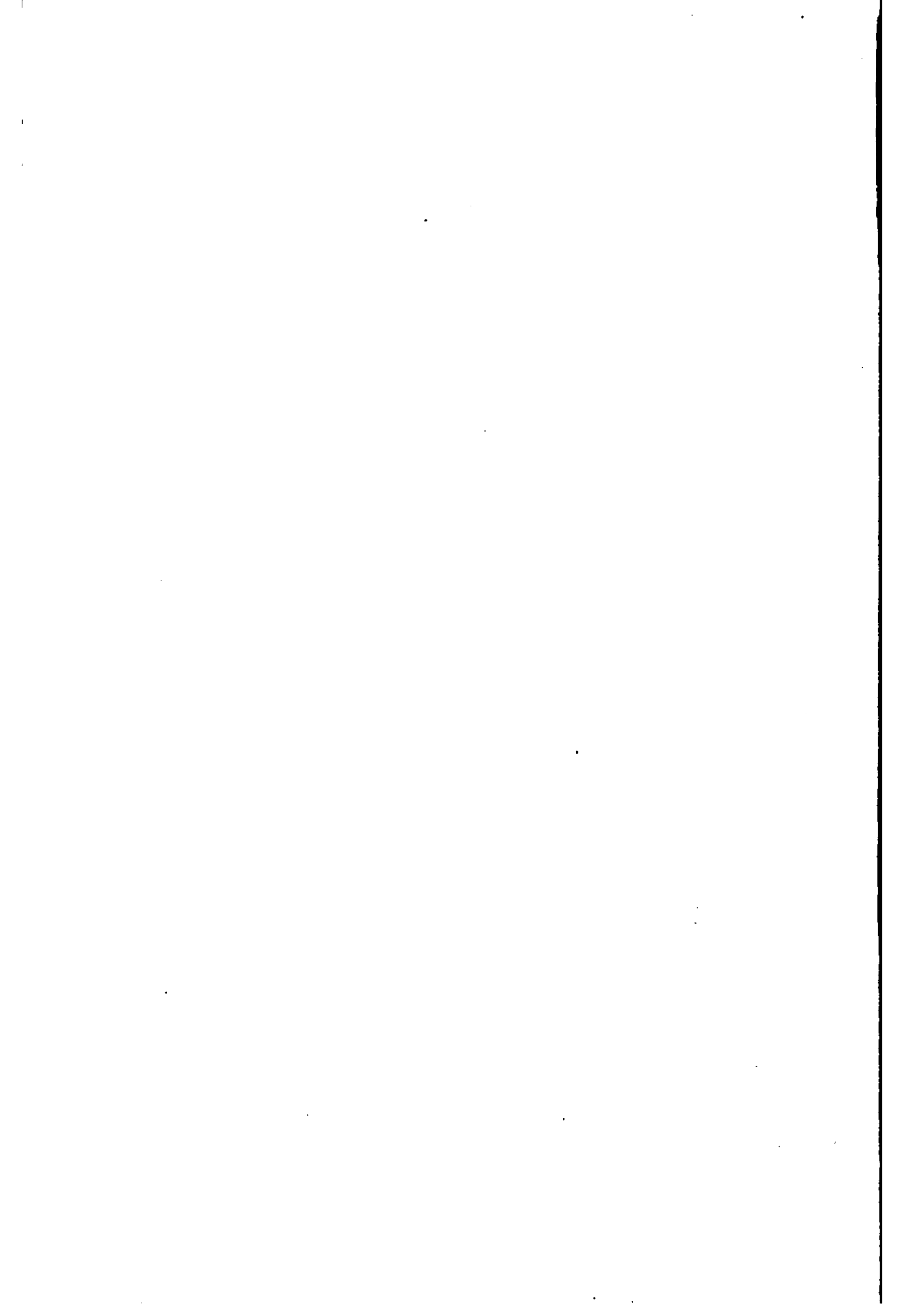
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Association



No. 16.

ANNUAL REPORT

OF THE

ASSOCIATION

OF

Ontario Land Surveyors

ORGANIZED 1886. INCORPORATED 1892.

TORONTO

1901.

The next Annual Meeting will be held at Toronto on
Tuesday, Feb. 25th and following days.

PRINTED FOR THE ASSOCIATION BY
HENDERSON & CO., LOMBARD STREET,
TORONTO.

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OUR LATE BELOVED QUEEN.

BORN MAY 24th, 1819.

DIED JANUARY 22nd, 1901.

AGED 81 YEARS.

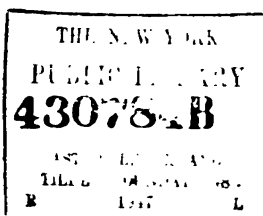
This was her Majesty's most recent portrait, and was taken at her special command by Lafayette. She is shown wearing the shamrock in her bonnet.

No. 16.

ANNUAL REPORT
OF THE
ASSOCIATION
OF
Ontario Land Surveyors
ORGANIZED 1886. INCORPORATED 1892.
AND
PROCEEDINGS
AT THE
NINTH ANNUAL MEETING
SINCE INCORPORATION
HELD AT
TORONTO
26th, 27th and 28th February, 1901.

24/

PRINTED FOR THE ASSOCIATION BY
HENDERSON & CO., LOMBARD STREET,
TORONTO.



PATRONIZE OUR ADVERTISERS.

NOTICES.

Members and others will be supplied with copies of the Annual Reports for 1886, 1887, 1888, 1889, 1891, 1892, 1893, 1894, 1895, 1896, 1897, 1898, 1899, or 1900, upon remitting to the Secretary fifty cents, for each copy required.

Copies of the "Manual" may also be had from the Secretary, price fifty cents.

Each member of the Association is reminded of the fact that for the next Annual Meeting a good programme is most desirable, and to insure its preparation it is not now too early to bear the matter in mind.

In addition to its use as a library, the Repository now serves as a drafting room for members when copying Crown Lands plans and notes.

Published annually by the Association of Ontario Land Surveyors. Edition, 1350 copies; price, 50 cents.

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PREFACE.

To the Members of the Association of Ontario Land Surveyors :

The Proceedings of the Association at its Ninth Annual Meeting are herewith presented.

There are no additions to the "Manual" this year, but at page 197 will be found the Regulations, etc., relating to the admission of Land Surveyors, which will be found convenient.

Respectfully submitted on behalf of the council.

VILLIERS SANKEY,
Secretary.

R V P L

CONTENTS.

	PAGE
Minutes of the Ninth Annual Meeting.....	9
President's Address	35
Nomination of Officers	38
Members in attendance at the Ninth Annual Meeting.....	44
Result of Elections for 1901-1902	44
Report of the Council of Management for the year 1900.....	45
" Board of Examiners.....	47
" Secretary-Treasurer.....	48
Statement of Balances, Receipts and Expenditures, between 28th Feb., 1900, and 27th Feb., 1901.....	51
Report of Committee on Repository and Biography	51
" Publication Committee	52
" Committee on Land Surveying.....	53
" " " " Question Drawer.....	53
" Drainage Committee	61
<i>Discussions:—</i>	
Standard of Measure.....	67
Surveyors as Referees.....	75
Track Surveying.....	81
<i>Papers:—</i>	
Local Deflection of the Plumb Line.....	85
Polar Expedition	99
Level of Lake Erie.....	115
Surveying by Photography.....	123
Canadian Association of Civil Engineers and Surveyors.....	135
Surveys for Municipalities.....	151
Examination Papers, Preliminary and Final	161
List of Members.....	181
List of Deceased Members	196
Extracts from By-Laws and Statutes.....	197

ASSOCIATION OF
ONTARIO LAND SURVEYORS
(INCORPORATED 1892)

Organized 23rd February, 1886.

OFFICERS FOR 1901-1902.

PRESIDENT.

JAMES DICKSON, - - - - - Fenelon Falls.

VICE-PRESIDENT.

W. R. AYLSWORTH, - - - - - Belleville.

CHAIRMAN OF COUNCIL.

GEORGE B. KIRKPATRICK, O.L.S., - - - - - Toronto.

SECRETARY-TREASURER.

MAJOR VILLIERS SANKEY, O.L.S., - - - - - Toronto.

MEMBERS OF COUNCIL.

J. W. TYRRELL, Hamilton. }
J. McARCE, Rat Portage. } For Term ending April, 1904.

A. J. VANNOSTRAND, Toronto. }
C. A. JONES, Petroea. } For Term ending April, 1903.

G. B. KIRKPATRICK, Toronto. }
A. NIVEN, Haliburton, } For Term ending April, 1902.

AUDITORS.

CAPT. GAMBLE, - - - - - Toronto.
A. J. VANNOSTRAND, - - - - - Toronto.

BANKERS.

Imperial Bank of Canada (Yonge Street Branch), Toronto.

BOARD OF EXAMINERS

C. E. Kirkpatrick, Chairman, **E. Niven**, **P. S. Gibson**, **M. J. Butler**, **T. Sankey**, Sec.

NOTES—Board meets at Library and Department, Parliament Buildings, Toronto, on Mondays, Secretary calls upon.

COMMITTEES

GENERAL

LESS STUDYING—**T. D. Evans**, Chairman, **H. S. Lauderer**, **A. R. Davis**, **R. W. McDunn**, **M. Javiler**, **H. H. Gibson**, **A. Niven**, **A. S. Russell**.

DEBATING—**C. A. Jones**, Chairman, **F. V. Fairclough**, **F. W. Hater**, **W. G. McGeorge**, **J. H. Moore**, Sec. &c.

RECREATING—**E. G. Barron**, Chairman, **A. T. Langneil**, **Jas. Hatcher**, **R. McDowall**, **F. F. Miller**, **A. F. Walker**, **Jas. Warren**.

ENTERTAINMENT—**A. P. Walker**, Chairman, **Willis Chipman**, **H. L. Eaton**, **H. H. Gibson**, **H. DeJ. Sewell**, **T. Sankey**, **F. Whitson**.

PUBLICATION—**K. Gamble**, Chairman, **H. J. Brown**, **H. L. Eaton**, **W. A. MacLean**, **A. J. Van Nostrand**.

TOPOGRAPHICAL SURVEY—**L. B. Stewart**, Chairman, **Chas. J. Klotz**, **M. J. Butler**, **Willis Chipman**.

SPECIAL

POLAR RESEARCH—**Willis Chipman**, Chairman, **Jas. Correns**, **C. J. Murphy**, **Wm. Ogilvie**, **L. B. Stewart**, **J. W. Tyrrell**, **J. F. Whitson**.

EXPLORATION—**J. W. Tyrrell**, Chairman, **Alex. Baird**, **D. Beatty**, **John McAree**, **Jas. Robertson**, **G. E. Selvester**, **T. B. Speight**, **E. Stewart**.

REPOSITORY AND BIOGRAPHY—**A. J. Van Nostrand**, Chairman, **Willis Chipman**, **R. P. Fairbairn**, **P. S. Gibson**, **T. H. Jones**, **C. E. Kirkpatrick**, **C. Unwin**.

PROGRAMME OF THE Association of Ontario Land Surveyors

(INCORPORATED.)

AT ITS NINTH ANNUAL MEETING HELD AT TORONTO.

26th, 27th AND 28th FEBRUARY, 1901.

PROGRAMME.

Tuesday, 26th February—Morning, 10 o'clock.

AT THE REPOSITORY, PARLIAMENT BUILDINGS.

Meeting of Council.

Meeting of Standing and Special Committees.

Afternoon, 2 o'clock.

President's Address.

Report of Secretary-Treasurer.

Report of Committee on Repository and Biography. A. J. Van Nostrand,
Chairman.

Report of Committee on Publication. K. Gamble, Chairman.

Evening, 8 o'clock.

(At Repository)

Paper—"Engineers and Surveyors." A. R. Davis.

Wednesday, 27th February—Morning, 10 o'clock.

AT ENGINEERS' CLUB ROOMS, 94 AND 96 KING ST. WEST.

Report of Council. G. B. Kirkpatrick, Chairman.

Paper—"Surveys and Plans for Municipalities." H. J. Bowman.

Discussion—"Duties of Surveyors as Referees."

Report of Land Surveying Committee and Question Drawer. W. R. Aylsworth
Chairman.

Afternoon, 2 o'clock.

"Regulation of the Level of Lake Erie." F. W. Farncomb.
Report of Drainage Committee and Question Drawer. A. S. Code, Chairman.
Discussion—"Reclamation of Lands under the Several Drainage Acts."
Report of Engineering Committee. M. J. Butler, Chairman.
Report ~~re~~ Standard of Measure. V. Sankey.

Evening, 8 o'clock.

ANNUAL DINNER. McCONKEY'S RESTAURANT.

Thursday, 28th February—Morning, 10 o'clock.

AT ENGINEERS' CLUB ROOMS, 94 and 96 KING ST. WEST.

Report of Topographical Survey Committee. Otto J. Klotz.
Paper—"Topographic Photography." J. N. Wallace.
Discussion—"Track Surveying."
Report of Exploration Committee, "Digest Northern Ontario Explorations."
L. B. Stewart, Chairman.
Report of Committee on Entertainment. H. L. Esten, Chairman.

Afternoon, 2 o'clock.

Nomination of Officers—(President, Vice-President, Secretary-Treasurer, Auditors,
two members of Council.
Ratification of By-Laws.
Unfinished Business.
New Business.
Adjournment.

Minutes of the Ninth Annual Meeting

OF THE

ASSOCIATION OF

ONTARIO LAND SURVEYORS,

Held at the Repository, Parliament Buildings, Toronto,
on FEBRUARY 26th, and at the Engineers' Club
Rooms, 94 and 96 King Street East, Toronto,
on FEBRUARY 27th and 28th.

MORNING SESSION.

Meeting of the Standing and Special Committees.

Repository, February 26th, 1901.

The Ninth Annual Meeting opened at 3 p.m., the President, Mr. Ross, in the chair.

The Minutes of the previous meeting as printed in the Proceedings for 1900 were taken as read.

The President then read his address, in which he fittingly referred to the death of Her late Majesty Queen Victoria. After some discussion it was moved by Mr. Aylesworth, seconded by Mr. Kirkpatrick, that the address be received and printed in the Proceedings. Carried.

Mr. Kirkpatrick, referring to the death of Her late Majesty requested the Chairman to name a Committee to draft an address of condolence to His Majesty King Edward the Seventh, to be forwarded through the proper channel, that it may be laid at the foot of the throne.

The Chairman named Messrs. Kirkpatrick, Dickson and Aylesworth. Carried.

The report of the Committee on Repository and Biography was presented by Mr. A. J. Van Nostrand, and on motion, was received and ordered to be printed.

The report of the Committee on Publication was presented by Capt. Gamble, and on motion, was received and ordered to be printed.

Mr. Sankey brought up the subject of the preparation of papers for the Annual Meeting. After some discussion it was decided to request the Chairmen of the several Committees, to take up the matter early in the year, and communicate with those members most likely to contribute.

The meeting adjourned until 8 p.m. at the Repository.

EVENING SESSION.

Tuesday, 26th, February 1901, 8 o'clock p.m.

Mr. George Ross, President.

Mr. Villiers Sankey, Secretary.

Paper by Mr. A. R. Davis (Napanee), entitled "Engineers and Surveyors."

Mr. Davis:—Mr. President and gentlemen: The object of this paper is to assist in paving the way for the closer union of our civil engineers and surveyors. For the sake of the argument I suggest to the meeting, "The Canadian Association of Civil Engineers and Surveyors," with a question mark. Reads paper.

The President then tendered the thanks of the Association to Mr. Davis for his very valuable contribution.

Mr. Davis:—I thank you, Mr. President and Gentlemen, for the kind reception you have given the paper. It was practically a new field for me to travel, and I wrote to two or three members of this Association, for some hints in reference to the matter, men who I knew knew more about the matter pertaining to the union of the two professions than I did. But I found that "mum" was the word. I got no replies. Then I took the course that I thought looked most reasonable, and while giving vent to certain thoughts, in reference to this question, that have been prominent in my mind for a number of years, I endeavored as far as possible to avoid the extremes that sometimes injure the cause more than they help it.

I am very much pleased with the very fair and excellent feeling that prevails among the members of the Association in reference to this amalgamation. There is no question that we (Surveyors and Engineers) are practically members of the same profession. In my experience as a Surveyor and Civil Engineer I am running across every year Surveyors and Engineers from

the Atlantic to the Pacific—I meet them in the Maritime Provinces and in all the other Provinces. I will give you one illustration of the feeling that exists: During last summer while on Railway Work I came into the camp of a Surveyor belonging to one of our neighboring Provinces, in the employ of a rival Railway Company—my camp was near his, and we were both aiming for the same pass between the mountains; in fact his Company had located its line, and this Surveyor was taking some right-of-way notes—he was a stranger to me, a man I had never seen before. I called him by name, passed the time of day, and said, That I came to see him in regard to their location as I wished to avoid crossing it; I thought there was room enough in the country for both of us; and I asked him if he would kindly give me some information. He invited me into his camp; and got out his plan of location, and said, “Here, take this and make a copy of it; you can do it over in your own camp—here is our location.” I said, “This is very kind of you; there is no indication of any bitterness towards the employes of your rivals.” “Oh,” said he, “That is all right; if the heads of our companies require to get at logger-heads, well and good; we men in the field cannot afford to dispute over these matters, we have enough troubles of our own.” He treated me very kindly and invited me over to dinner the next day, and we had a sociable time. Such are the men we are meeting as Surveyors and Engineers, a common brotherhood from the Atlantic to the Pacific; and they are as intelligent men as you can meet anywhere in this Dominion to-day; and yet they are apart; they are separate; there is a line of cleavage running all along, although this is a new country, as Mr. Chipman says, and there are only a few men employed in the profession. The rising generation, the young men who are entering the profession can be qualified for whatever work we have to do; and the examinations can be made such as to meet the requirements, all can meet on common ground, and we will strengthen ourselves and strengthen the calling; and make ourselves a name that will be honored throughout the Dominion, and as with all other professions, the standard of our profession will be raised and we will not suffer. We should not lower our standard but rather elevate it; and certainly consolidation will have a tendency to elevate, if it be carried out on right principles. (Applause).

Moved by Mr. Sankey, seconded by Mr. Bowman that the new council shall appoint a Committee to be known as the

"Legislation Committee," to take up matters concerning amalgamation of the Surveyors and Engineers, or as the case may be.

The President put the motion, and, on a vote having been taken, declared it carried.

A Paper by Mr. Klotz on the Deflection of the Plumb Line.

Mr. Sankey:—There are two plans connected with this paper, and I think if I pass them round so that they may be seen the paper which I am about to read will be more easily understood. Mr. Klotz sent this printed copy of the paper to the Association; he has already read the paper before the Ottawa Literary and Scientific Society, and I took it upon myself to write, asking him if he had any objection to the paper being read before this Association and published in our proceedings, as it seemed to be one of very great interest to Surveyors in general. I got a very nice letter from him, saying he would be very much pleased, and very proud if we would do him the honor of reading his paper and publishing it in our proceedings.

Mr. Sankey reads the paper.

Mr. Aylesworth moved, seconded by Mr. Davis that the paper as read be received and published in the Minutes of our Proceedings and that a vote of thanks be tendered to Mr. Klotz.

The President put the motion, and, on a vote having been taken declared it carried.

Adjourned to Wednesday, 27th February, 1901, at 10 o'clock a.m., at the Engineers Club, 94-96 King St., West, Toronto.

MORNING SESSION.

Wednesday, 27th February, 1901, 10 a.m., at the Engineers Club, 94-96 King Street, West.

The President called the meeting to order.

REPORT RE STANDARD OF MEASURE.

Mr. Sankey:—Mr. President and Gentlemen, the object I have in making this a verbal report rather than bringing it in in connection with the official reports is, that it would be well now for us to consider if any other suggestions should be made with

regard to our standard tape. In the report of last year's Proceedings the matter is dealt with as it was discussed; and at the end of the discussion it was moved by Mr. Aylesworth and seconded by Mr. Ross, that the Board of Examiners be recommended to adopt a 33-foot steel tape as the standard of measurement to be given in future to those who pass the final examination. The President added the suggestion that a sufficient number might be purchased to allow the older members to get them at a nominal figure and hoped that they would be able to do so. Mr. Wilkie said, "For myself I should be very glad to purchase one, and I think with Mr. Sankey that the 33-foot would be the most suitable. I do not anticipate any trouble in comparing the length of my 100-foot chain with the 33-foot standard." Following that instruction out, immediately after the last annual meeting, I opened communications with the various manufacturers of steel tapes through their agents or representatives in Toronto. After a good deal of correspondence we found that Chesterman would not make anything out of the ordinary run of tapes he was making. He would sell us 50-foot or 33-foot tapes, just as he had them in stock. And some of the manufacturers in the United States took the same position. Finally the Lufkin Rule Company of Saginaw stated that they would make a tape according to our pattern if we would order one hundred of them. We found on enquiry that the tapes would cost about \$4 apiece. We have not yet ascertained whether we can get them in free of duty, or not. Neither Mr. Kirkpatrick, the Chairman of the Council, nor I, felt justified in giving an order that would entail the expenditure of so much money; but we said we would guarantee an order of \$100 worth of tapes, and undertake to make this tape the Association standard, that is, we would not go anywhere else to get them made. On that understanding, the Lufkin Rule Company have sent me this tape which I have in my hand as a pattern; it is made on the design that was furnished to me. Now that you have the tape stretched out, you will see that on the face, at the front end the foot is divided into inches, 8ths and 16ths, with the half inch divided further on. There is one improvement I suggest, and that is to get the zero taken out, so that the graduations would be perfectly clear. On the other side of the tape, the link is divided into 10ths and 100ths, merely. Then, we have our own stamp on it, "O.L.S. Standard." At the box end of the tape, the foot is divided into 10ths and 100ths. These tapes will cost \$4 net.

There is one advantage with regard to the 33-foot length; it cannot be very well used to make a survey, and it is not intended for that purpose; it will also test the 33-foot and 50-foot link tape at the same time, as they are coincident at the end of the proposed tape.

In order to see how we could get a proper standard, from our Canadian standpoint, the manufacturers sent a sample to Ottawa some time in August last, to get a proper comparison of this tape with the Dominion Land Standard, or really the Department of the Interior Standard, but their mural Standard is broken down, and they cannot compare a tape so long as 33-feet. For that reason I am not able to issue any tapes as yet, and will not be able to do so until we get them stamped so that they will be official for Canada.

Mr. Sewell:—Is it the intention to have the Dominion stamp on them also, so that they will apply as standards for Ontario and the Dominion?

Mr. Sankey:—Yes; so that it cannot be said that the Ontario Land Surveyors' tapes are not standard with the Standard of the Inland Revenue Department.

In making the change from our old rooms to the new ones, I happened to strike a bundle of papers that were without enclosure, and on looking into the bundle I found what I had been looking for for a long while; and it would be interesting to read these letters, in order that they may be published. You will remember that yesterday evening at the meeting I had the pleasure of what is the original standard of the Ontario Land Surveyors, and has been in the possession of the various Commissioners of Crown Lands for many years.

The letter I have read is from Thompson & Sons of Fleet Street, London, written to Mr. W. H. Price, Esquire, Crown Lands Commission, and is dated 1st September, 1850, and reads as follows:—

To the Hon. Secy. of the Crown Lands Commission, 1st Sept. 1850.

My dear Sir, I have the honor to acknowledge the receipt of the letter of the 28th inst. in relation to the standard of the 33-foot link tape, and in reply to inform you that the same has been forwarded to the proper authorities for their consideration.

I am, Sir, very respectfully,
Your obedient servant,
Wm. H. Price, Esq.

The Standard Yard was carefully compared with the Tabular Standard Scale of the Royal Astronomical Society and the result of the comparison makes it .000008 of an inch longer than the middle 3 feet, or Standard Yard upon that Scale.

Many years ago Mr. Edward Troughton, for insertion in Dr. Kelly's Cambist, compared a number of foreign with our English measure and amongst the rest an old French Foot, which he found equal to 12.7893 English Inches. Now according to this determination, the Scale of 3 French feet should measure 38.3679 inches upon the Royal Astronomical Society's Scale, and we have satisfaction in reporting that our comparisons make it exceed that length by $\frac{1}{25000}$ of an inch only.

The temperature at which the comparisons were made was between 64° and 66° of Fahrenheit's Thermometor, but as all the Scales are made of brass this is of little or no consequence.

We remain, Sir,

Your most obedient servant,

TROUGHTON & SIMMS.

Mr. Sankey:—That shows that this bar of ours was properly compared in England.

In 1875 a considerable correspondence took place between the Commissioner of Crown Lands in Ontario and the Commissioner of Inland Revenue in Ottawa on the subject of having our Ontario Tapes properly stamped. That correspondence is probably not very interesting to us; it goes into the question as to whether the Dominion held entire control of measures which nobody of course now contradicts. There is a letter here of September 17th, 1877, written by Mr. A. W. Brunell, Commissioner, that I think is most important; it is as follows:—

OTTAWA, September, 19th, 1877.

SIR,

1. Having completed the verification of your standard bar it was delivered to Mr. Murphy on Monday and I have now the pleasure to enclose an indenture of the verification.

2. You will observe that your bar is somewhat short of the standard length but the error is so small as to be of no importance in relation to its practical use.

3. Nevertheless I think it is desirable that all measures used as standards of comparison should have their exact value strictly defined. I have therefore taken considerable trouble in defining the exact value of this particular standard which is perhaps the most important of any lineal standard used in the Province of Ontario.

4. I may observe that the defining lines on your bar as compared with those on the Dominion Standard are so coarse

that it became necessary to measure their breadth and on doing so I discovered a measurable difference between the two defining lines. This difference is equal to .00057559 inch and I have therefore computed the length of the bar to the centre of the defining lines,

5. I am very glad to have had the opportunity of making these comparisons and shall endeavor to obtain similar comparisons of the Surveyor's Standards used in the other Provinces.

I have the honor to be, Sir,

Your obedient servant.

A. W. BRUNEL, *Commissioner.*

In view of these letters and the fact that the mural Standard at Ottawa is broken down, the Board of Examiners suggested that we should find out from Mr. Stewart of the School of Science whether they have any instrument there from which this comparison could be made by us; and he tells me there will be no difficulty at all in comparing our bronze standard with a 33-foot tape, the idea being that the Secretary of the Board shall keep that tape as a standard in his possession, with the record of its length made on the comparator up at the School of Science. Then every tape that is issued is to be compared with that 33-foot steel tape and stamped accordingly. We will stamp on the face of the tape our own Ontario Land Surveyors' mark; and each tape will be numbered so that a record may be kept of those to whom the tapes are issued.

The Council suggested that the next step to be taken would be for the Commissioner of Crown Lands to get authority from the Dominion Government for the Secretary of the Board of Examiners to be an inspector for the purpose of marking Ontario Land Surveyors' tapes, now that we are in actual possession of a properly compared standard.

These I think are the principal points that I was going to put in my paper which I did not expect to have to read until this afternoon; but as Captain Bernier is to lecture before the meeting it was thought well to bring the matter up at this morning's Session. If there are any suggestions to be made as to the marking of the tape or otherwise I would be very glad to get them.

Mr. Dickson:—I think stamping the certificate on the tape is a good idea. At present if a certificate is lost the owner of the tape has nothing to show that there was a certificate with it; the number even is not on the tapes now.

Mr. Sankey:—Mr. Unwin, the late partner of Messrs. Murphy & Esten, had the Dominion Standard with a certificate; and Messrs. Esten & Murphy found they would have to get the tape re-registered in their own names before it would be official for them to use it for Dominion Lands work. I suppose from that that there was some method of marking the tape. The idea I had in my mind was to etch a number on the tape, somewhere near the front of it, and open a register which would show, for instance, that Mr. James Dickson got tape No. so and so on such a day; but I did not propose to issue any tape that fell short of or was longer than the stamped standard; of course it would be utterly impossible for us to give a certificate that any tape like this was .006 long at a temperature of 40 degrees, or anything of that kind.

Mr. McDowall:—Who would be allowed to manufacture these tapes?

Mr. Sankey:—These tapes, which will be the standard, will be manufactured by the Lufkin Rule Company; they will be issued to Surveyors to test any other tapes or chains they want to use, in the same way as they are supposed to use the old wooden stick.

Mr. McDowall:—Did you say “supposed?”

Mr. Sankey:—I did say “supposed.” The only use I have ever seen those old sticks put to was to put through a strap on a theodolite box to help a man to carry it along through the bush.

Mr. McDowall:—Do you think in the life time of that tape we might have the metric system in force.

Mr. Sankey:—I do not know about that. There is quite a movement in Toronto to bring about the adoption of it; but I have heard some practical men, both Engineers and Surveyors, say that they did not at present see how either Great Britain or the United States can spend money necessary to alter every machine process that is used in the United States and England; because all the screw cutting machinery of those two great countries would have to be thrown into the waste heap. Whether the change to the metric system will come about in our day or not I do not know.

Some years ago, when it was being discussed, I addressed this meeting on the idea of using decimal measures altogether and doing away with inches and the division of the inches into 8ths, using instead 10ths and 100ths. I fancy a great many

Surveyors do use decimal tapes altogether as I notice in descriptions that acres and 100ths of acres are used, and many Surveyors in this part of the country now give their descriptions in feet and 10ths. But the difficulty I met with there was I found the practical man, the carpenter, said, I cannot get wood cut to feet and 10ths, I have to get it cut to inches and 8ths, because the machinery for cutting wood is graduated in that way. I find too that the iron men say, Plates are all rolled that way and bolts are made that way, and the threads to the inch in screws are all cut as so many 16ths or 32nds., etc. If there is a possibility of changes in these modes of measurement happening in a short while, the metric system may possibly be adopted.

Mr. Sewell:—The fact is that feet and inches are more convenient for sub-division than a decimal system; when you come to machinery twelve is much more convenient for sub-division than ten; when you get your feet into decimals it is a very awkward thing and there is no absolute correctness.

Mr. McDowall:—There would be no room on a tape to put a metric system.

Mr. Sankey:—Yes, if it became necessary, there is the back of the far end of the tape. We could use the last link on the back of the tape, and substitute a meter there. These manufacturers have all the plates to do that. You can get a plate graduated on one side in feet and inches and on the other side into meters and 10ths. There would be no difficulty about that at all. But those already in possession of these tapes would find it difficult to have the alteration made.

Mr. McDowall:—That is what I mean.

Mr. Sankey:—The tapes would have to be sent back to the manufacturers.

President Ross:—Why not buy a new tape.

Mr. McDowall:—Yes, I suppose the tapes would be pretty well worn.

Mr. Sankey:—I wish Mr. Butler were here because he has taken quite an interest in this matter and could have told us of some practical experience he has had lately. He was getting out a specification for a building on some German principle that was all worked out in meters and decimeters; and I forget now how many reams of foolscap it took to get out the measurements he required, for the workmen who were going to build. He says

it was an awful job; that he had to take out the measurements to two or three places of decimals every time; and he showed us one or two little calculations that filled most of a page of foolscap. If one had a large specification to get out in that way it is easy to see how great the difficulty of changing from one system to the other would be.

Mr. Sewell:—It would be an endless job. The change is not likely to come in our life-time nor in the life-time of our grandchildren.

Mr. H. J. Bowman:—Do you propose to charge \$4 for one of these tapes?

Mr. Sankey:—Yes.

Mr. Dickson:—Are we likely to get them in free of Duty?

Mr. Sankey:—We may possibly get them in free under the head of scientific instruments.

Mr. Dickson:—They would be government supplies.

Mr. H. J. Bowman:—If the metric system should be adopted in say ten or fifteen years from the present time I suppose we could stand the price of another standard and probably it would be better to have one then any way. In the meantime it seems to me it would complicate matters to have links, and feet, and meters all on the same standard. If the metric system is adopted, which no doubt it will be in time, because like everything else the system of measurement should be uniform throughout the world; and if Germany and France and the other Continental countries have come to that standard there is no reason why England and the United States should not do so as well. I think some of the difficulties at least will gradually fade away. But it seems to me for the present time we had better just have feet and links, and when the metric system is adopted, if it ever is, the old systems will have to be dropped. It is a question whether in measuring land we should not drop one or the other now. There is no doubt that the method of expressing areas in chains and links is very convenient. Young Surveyors are apt to think chains and links are out of date; but as we go on in practice we gradually drop the feet and inches, as more difficult to apply than chains and links. Feet and inches are not in the decimal system, whereas chains and links are; and the mere fact of chains and links being so much more convenient shows us how much easier the metric system will be for all measurements after a while when all is on the decimal system.

Mr. Sewell:—There is one great objection to the metric system; it is based on latitude in Paris; our yard is based on Greenwich, practically being the swing of a seconds pendulum at a temperature of 62 Fahrenheit at Greenwich, so that we have always in British Territory the standard of the yard. If we had the metric system and we chanced to be at war with France we couldn't get a standard.

Mr. H. J. Bowman:—Mr. Sewell is very patriotic. I will not be behind him in patriotism but I want to remind him that the question is not whether we should adopt a standard that is derived in Paris or in Greenwich, but the decimal system. We have this system in our currency, and we do not consider ourselves unpatriotic. We no longer have to wade through pounds, shillings and pence, but we have the United States method of dollars and cents and it is a very good method too. All we want, after a while, is to have the decimal system carried out for our measurements, both superficial and cubic, so as to apply it to everything. I think, speaking on the matter of patriotism, as we have adopted the decimal system in currency we might use it in everything else without in any way being thought disloyal to the great Empire of which we form a part.

Mr. Sewell:—We have the decimal system in use. There is our Surveyors' chain, which is a four rod chain, and is based on the English yard. I object to our adopting a French standard as in the metric system, not because it is decimal, but simply because the data by which it is arrived at is outside of British Territory.

Paper: "Surveys for Municipalities" by Mr. H. J. Bowman.

Mr. Bowman:—The title of this paper, according to the programme is "Surveys and Plans for Municipalities;" but I found out as I went along that probably one-half of the paper was sufficient at the present time, so I have omitted "Plans" and the title will now stand, "Surveys for Municipalities."

"Moved by Mr. Aylesworth, seconded by Mr. Dickson, that the paper be referred to the Legislation Committee and printed in the minutes and that the thanks of the Association be tendered to Mr. Bowman," the President put the motion, and, on a vote having been taken, declared it carried.

The President tendered the thanks of the Association to Mr. Bowman.

Mr. Bowman:—Thank you, Mr. President.

The President called on Mr. Aylesworth to present the report of the Committee on Surveying.

Mr. Aylesworth:—Your Committee on Surveying has nothing special to report this year. The Chairman of the Committee wrote to most of the members of the Committee to present papers, but he has not received any papers. The Committee has had under consideration and begs to submit the following conclusions;

Read answers to questions 1, 2 and 3, which were illustrated by Mr. H. H. Gibson on the blackboard. On motion answers to questions 1, 2 and 3 were approved of by the meeting.

12.35 p.m., adjourned to 2 o'clock p.m.

AFTERNOON SESSION.

Wednesday, 27th February, 1901, 2 o'clock p.m.

The President called the meeting to order.

Mr. Aylesworth concluded the reading of the report of the Surveying Committee, and on motion the several answers to the questions therein contained were adopted.

Moved by Mr. Gibson, seconded by Mr. Dickson, that the report of the Committee be adopted as amended. Carried.

Captain Bernier here delivered his lecture.

President Ross:—Captain Bernier has not only exhibited his views but he has shown us that he knows what he is talking about, and seems to appreciate our sympathy. We desire to show him that we are deeply interested in this work and that we would be glad if the Government granted him the funds necessary to equip his expedition.

I would like to hear from any one present or to receive any motion any one has to make with regard to this matter.

Mr. Tyrrell:—We have all been delighted with the address which Captain Bernier has favored us with this afternoon, and the beautiful views to which we have been treated. I do not propose at all to give anything in the way of remarks myself but merely to express my deep appreciation of the address which I consider admirable. We as Canadians should be proud of Captain Bernier and should certainly give him our support in every tangible way.

As he intimated, I did, a couple of years ago, express my belief in his enterprise; and I can only reiterate that fully this afternoon. Captain Bernier is undoubtedly on the right track. It is proven beyond question that the drift is as he has indicated and it seems to me that the whole problem of reaching the Pole is after all a simple one now that we have the light thrown upon the subject by such a man as Nansen whom most of us have had the pleasure of hearing.

I am sure we all wish Captain Bernier every success, and it would afford some of us much pleasure, to see an Ontario Land Surveyor a member of his party. I should be only too glad, if I were at liberty to do so, to volunteer my own services.

I have much pleasure in moving a hearty vote of thanks to Captain Bernier for his kind address.

Mr. Dickson:—I am sure we are all under an obligation to Captain Bernier for having taken the trouble to come here and address us to-day. It is something I have read a great deal about, but I am no sailor myself, and personally I know nothing about the drift. But I have always taken a great interest in Polar expeditions and I believe if I were forty years younger I would almost give my right hand for the privilege of going with him.

He has been preceded by a great many eminent men, Englishmen, Americans and others. I was once talking to an old English Sea Captain, when he, looking at a map of the world, traced with his finger along to the Pole, and said, It can be done and England ought to do it. I still think that, as he said, it can be done. Although millions have been spent and hundreds of lives have been lost and although we cannot say whether very great results may be derived from the discovery of the Pole, the Captain's efforts ought to be seconded and Canada ought to help to pay the cost. If Captain Bernier is giving his own time, it is all that should be expected of him; and I do not believe there is a politician in the whole of Canada who would utter one word of complaint if the Government footed the whole bill. England has footed a great many bills to try to attain the same object, and I hope that Canada will assume the responsibility, at any rate she will do what she can to forward the scheme. When Captain Bernier returns, as I hope he will, whether successful or not, we will look upon him as one of the greatest explorers Canada has produced.

I have very much pleasure in seconding the motion calling for a vote of thanks. (Applause).

President Ross put the motion, and on a vote having been taken, declared it carried unanimously; and tendered the thanks of the Association to Captain Bernier for his very interesting and instructive lecture, and assured him that he had the hearty sympathy of the members of the Association.

Captain Bernier:—I feel highly honored at being permitted to give you my views upon the subject of the North Pole. I have made this question a study for twenty-three years, and if it is God's will I hope to reach the Pole. I will do my part to get there, and I have it in my inner soul that I can accomplish it.

I have heard some people remark, "Captain Bernier has been a master for thirty-one years, and he must be an old man now." Let me tell you, I am not an old man; I am not as old as I may look. I have been accustomed since my childhood days to outdoor exercise. As I look about me here to-day, I see a great many white heads, a great many men of over sixty years of age, but I see that these men are still full of vigor, and the reason for that is that they have always led active outdoor lives, as I have; and when a man has led an active life he does not rust and when he does not rust he will wear for a long time. I am the smallest member of my own family—all my relations are about six feet tall—and it might be said that as I am the smallest my heart must be small; but my blood runs quick because it has not got so far to go. (Laughter).

If any of you gentlemen have friends in Ottawa I would like you to tell them what you think of what you have heard me speak of to-day. But if you think I am going in the wrong direction, now is the time to say so; do not let me go, and after I come back, say, Well you did not go the right way. What I learn from you is for the benefit of Canada. Canada is a big place there is no doubt but there is room yet for thousands and those thousands are steadily coming all the time from mother England, Ireland, and from France and they are populating what I call, Big Canada. Now, we want to take this Pole before anybody else does; and I think it is time now for us to conquer that little bit of northern land and water which may hereafter be some good and may bring in some results for Canada.

I thank you most heartily for your kind reception and your sympathy.

President Ross:—I would like to hear the opinions of the members in regard to the Government assisting Captain Bernier; and I would like to have a motion in regard to that.

Mr. Chipman:—I would move, if I can get a seconder, that a Committee be appointed comprised of Mr. Tyrrell, who has explored the North of Hudson Bay, Mr. Stewart, who has been in the Yukon, and the mover, to draft a proper resolution approving of the scheme of Captain Bernier; such motion also to include a recommendation that the Government bear the expense of the expedition. As one who has studied this problem beside the grate fire in my library, on paper, I certainly feel that Captain Bernier is on the right track. Many years ago I stated before this Association that the proper route was exactly the one which is now mapped out by Captain Bernier.

Mr. Proudfoot:—I have much pleasure in seconding the motion.

The President put the motion, which was carried unanimously on a standing vote.

President Ross:—I have very much pleasure in announcing to you, Captain Bernier, that this motion is carried.

Captain Bernier:—I feel greatly honored; and when I go before Sir Wilfrid Laurier, I will be very glad to say the Surveyors of Ontario are in sympathy with me.

On motion, the meeting adjourned until Thursday, 28th February, at 10 o'clock a.m.

MORNING SESSION.

Thursday, 28th February, 1901, 10 o'clock a.m.

The President called the meeting to order.

The President invited Captain Bernier to a seat on the platform.

Paper:—"Regulation of the Level of Lake Erie," by Mr. F. W. Farncomb, read by Mr. Tyrrell.

The President put the motion as follows: Moved by Mr. A. R. Davis, seconded by Mr. H. H. Gibson, that the thanks of the Association be presented to Mr. F. W. Farncomb for his paper and that the paper be published in the proceedings and on a vote having been taken, declared it carried.

President Ross here retired and Vice-President Dickson took the chair.

Paper:—"Topographic Photography," by Mr. J. N. Wallace; read by Mr. H. H. Gibson

Vice-President Dickson:—I am sorry there was not a larger attendance this morning while this paper was being read. It is a somewhat long and a very important one; photographic surveys are now taking a prominent place in our profession. I do not know much about photography myself, and I do not suppose I will ever learn. There is a great deal to be learned about it. One thing we do know is that a photograph is always correct. There is information in this report that is of great importance, not only to our profession, but to the legal profession, and to the public in general. The writer must have devoted a great deal of time and thought to it; I know from experience, that a man cannot sit down and write such a paper at a moment's notice. This paper should be published in full in our Minutes. I will be glad to hear any discussion on the matter.

Mr. Ford:—I would like to move a vote of thanks to Mr. Wallace for his paper and for the interest and trouble he has taken. Mr. Wallace is a personal friend of mine; and he has told me about the very arduous work he had out there. I am sure he took a great deal of time to write that paper. It is a matter that is of great interest to us.

Mr. C. A. Jones:—I have very much pleasure in seconding the motion.

Vice-President Dickson put the motion as follows:—Moved by Mr. Ford, seconded by Mr. C. A. Jones, that a cordial vote of thanks be tendered to Mr. Wallace for the very valuable paper which he has presented to this Association; and that the paper be printed in the Proceedings; and, on a vote having been taken, declared it carried.

Moved by Mr. Van Nostrand, seconded by Mr. H. H. Gibson, that the Report of the Topographical Survey Committee be taken as read, and printed in the Proceedings. Carried.

Moved by Mr. H. H. Gibson, seconded by Mr. Van Nostrand that the report of the Committee on Entertainment be taken as read and printed in the Proceedings. Carried.

On motion the meeting adjourned to meet at 2 o'clock p.m.

AFTERNOON SESSION.

Thursday, 28 February, 1901, 2 o'clock p.m.

President Ross called the meeting to order.

Mr. Dickson:—Before going on with the routine business of the meeting I have a resolution I would like to introduce. Yesterday, after listening to the very interesting lecture by Captain Bernier, it was the unanimous opinion of this Association that his scheme to reach the North Pole was a feasible one; that he had made thorough investigation and seemed to fully understand what he was doing, and was ready to offer himself up as a sacrifice on behalf of science. And this Association was of the opinion that as he was giving his time and his person we, as Canadians, should bear the expense; and a Committee was appointed to draft a resolution to that effect to be forwarded to Ottawa. That Committee has placed the resolution in my hands with letter attached and has asked me to move its adoption.

THE RIGHT HONORABLE SIR WILFRID LAURIER,
G.C.M.G., P.C., OTTAWA.

Sir,—I have the honor to transmit to you herewith on instructions from the Association of the Ontario Land Surveyors the enclosed resolution, which was passed at the Annual Meeting of the Association held in Toronto on the 26th, 27th and 28th days of February, 1901.

This resolution was discussed and carried, after having heard Captain J. E. Bernier's description of his proposed undertaking and the methods he intends to employ in order to accomplish his purpose of reaching the North Pole.

The meeting was a very representative one of the Land Surveyors of Ontario, some of whom have already been beyond the limit of the Arctic Circle, and are therefore, in a position to form an opinion as to the necessities and difficulties of, and the advantages to be derived from, such an undertaking.

I have the honor to be, Sir,

Your obedient servant.

VILLIERS SANKEY.

Secretary of the Association of Ontario Land Surveyors.

Moved by Mr. James Dickson, Vice-President of the Association; seconded by Mr. Willis Chipman, and resolved that:

"Whereas the Association of Ontario Land Surveyors has for many years made a study of Polar Explorations ;

And the Committee of the Association on Polar Research engaged Lt. Peary to lecture before the Association in 1896, and in 1897 the Association instructed this Committee to attend Dr. Nansen's lecture, after his return from his "Farthest North";

And the expeditions of De Long, Nansen, Abruzzi, and others, have established beyond doubt the theory of the constant and regular drift of polar ice from Behring Strait across the Pole towards Iceland ;

And several members of the Association have been engaged from time to time in exploring British America in the vicinity of the Arctic Circle ;

And the Association holds that all portions of British North America should be fully explored and mapped, and all of our northern heritage claimed ;

And the Association has heard Captain J. E. Bernier's lecture upon his projected voyage, and has heard his proposed equipment described ;

And they believe Captain Bernier to be a suitable and capable person to command a Polar Expedition :

Therefore this Association at its Annual Meeting, hereby fully endorses Captain Bernier's proposed route to reach the vicinity of the North Pole *via* Behring Strait, thence north-westerly along the coast of Siberia until in longitude 170° east, thence northerly as far as practicable into the pack ice, thence drifting across the Arctic Sea in the direction of Iceland to navigable water ; and believe Captain Bernier with proper support will succeed in his undertaking ;

And the Association would respectfully urge upon the Dominion Government, the desirability of bearing all expenses in connection with fitting out the expedition and equipping the same ;

And that a copy of this resolution be forwarded to the Premier of Canada."

This resolution was carried at the Annual Meeting of the Association of Ontario Land Surveyors, held in Toronto on February 26th, 27th and 28th, 1901.

VILLIERS SANKEY,

Secretary of the Association of Ontario Land Surveyors.

President Ross:—This resolution prepared by the Committee appointed at our meeting yesterday afternoon states the fact very clearly and properly and is very well drawn out. I take much pleasure in laying the resolution before you.

Mr. Tyrrell:—As a member of that Committee I might just state that we wished to embody in that resolution the fact that for years we have been not merely interested in a superficial way but we have taken a deep interest in this subject of Polar Ex-

ploration; and we have endeavored to put the resolution in a forcible way.

The President put the motion, and, on a vote having been taken, declared it carried.

President Ross:—Captain Bernier: I have very great pleasure in presenting you with a copy of this resolution which will be properly signed and sealed and a certified copy handed to you.

Captain Bernier:—Thank you, sir.

Mr. President, Vice-President and Gentlemen, I am very pleased to see that you have already made some start towards the North. This act of yours will be recorded in history. I have my life written down from the time I was twelve years old and to-day I am proud to say I will be able to register in my book that the Land Surveyors of Ontario have approved and further have declared that the proposed voyage to the Pole is by the proper route. With the help of God, we will reach there.

And this is for the benefit of Canada. When I was in England they said, Canada is a great place, a great country; if you can afford to send us 2,000 of your boys to help us in our difficulty surely you can send twelve or fourteen men to the North to explore and take what is your own land. I said, Gentlemen, I am one of them, and I am on the road. They said, if Canada will do something for you we will also be very pleased to give you some encouragement. Now, I am waiting for the Canadian Government to sanction it and for an appropriation, and then in England we will get some instruments or other things that we require for that voyage. Lord Strathcona was at my lecture, and he said he believed the climate would not keep any Canadian from going there; he said, The climate is such that when you get on the sea level of the polar basin it is nothing to compare with what we have in Winnipeg and Alaska.

I beg to thank you very heartily for your kindness to me, and I hope some day to come and tell you all about our voyage and our successes. As I said last night, I would feel very proud if one of the Surveyors of Ontario—one of the boys—would come along; and I am sure the application would be favorably considered and I would be proud to have one of the boys with me. (Continued applause).

President Ross:—I have here the report of the Committee appointed to draw up a suitable address of condolence to His Majesty the King.



To The King's Most Excellent Majesty

Most Gracious Sovereign,

The Association of Ontario Land Surveyors at its Annual Meeting held at the Parliament Buildings, Toronto, Canada, on February 28th, 1901, desires to place on record its deep sense of the loss sustained by the Empire in the death of

Her Most Gracious Majesty Queen Victoria

During her long reign her beneficent sway assisted to mould the various portions of the Empire into one harmonious whole, and all portions of the Empire mourn her loss.

Each member of the Association of Ontario Land Surveyors having, by virtue of his office, taken the oath of allegiance to the Sovereign, has felt and mourned her loss.

In renewing its allegiance to His Most Gracious Majesty King Edward the Seventh, the Association of Ontario Land Surveyors prays that his reign may be a long and happy one guided like that of his Illustrious Mother by Divine Providence.

William Lawkey
Secretary



Geo. Ross
President

Moved by Mr. Dickson, seconded by Mr. Kirkpatrick, that the report of the Committee as read be received and adopted, and that a copy of the resolution be transmitted through the proper channel.

The President put the motion, and on a vote having been taken, declared it carried.

President Ross:—We will have a statement now from Mr. Stewart regarding the Report of the Exploration Committee.

Mr. Stewart:—I regret very much that my report is not quite in shape for reading. I did not know until last Saturday that I was chairman of this Committee; no doubt that was through my own fault; and since then I have not had time to get my report quite in shape, but I shall have it ready in a day or so, and place it in the Secretary's hands.

The Programme mentions a "Digest of Northern Ontario Explorations." The result of the explorations last summer has not yet been made public, so of course the report cannot give any results. In that respect, about all that can be given is a statement of what was intended to be done.

Moved by Mr. Proudfoot, seconded by Mr. Gibson, that the report be taken as read, and printed in the Minutes. Carried.

Mr. Kirkpatrick:—I would suggest that the Chairman insert a digest of it in time for printing; getting it as soon as it is published. He can prepare a digest of it, and it can come out in our Annual Report

President Ross:—Could you state when you would probably have this report ready, Mr. Stewart?

Mr. Stewart:—It will depend now on when it is published. I suppose that in a week after it is published by the Department I could probably have my report ready.

President Ross:—We have on our programme a couple of items under the head of Discussion. One is on the "Duties of Surveyors as Referees," and the other is "Track Surveying." We would be glad to take up those discussions now. If we have present with us any member who will be kind enough to open up these subjects we will be glad to hear them.

We will first take up the discussion on The Duties of Surveyors, as Referees. I understand that three of our members have had experience along this line; I refer to Mr. Kirkpatrick, Mr. Van Nostrand and Mr. McDowall. We will be glad to hear from Mr. McDowall.

Mr. Chipman:—I would like to know if any member can enlighten us as to the variation of the magnetic needle on the Siberian side of the North Polar Region. What is the magnetic variation? Is it of such constancy and is there such force there as to produce a safe guide for navigators? I am interested in this on account of Captain Bernier.

Captain Bernier:—On De Long's voyage he experienced from 18 to 23 degrees east, then, as he went north and west, it was decreasing. Then when we go back to Dr. Nansen, I find it was westerly increasing. From the time he left his ship to 86° .14' there was a westerly deviation of 44° 4', increasing going north, therefore I conclude that at the Pole there would be no less than about 55° westerly, because when running the curves over known points, when I come to join the points I find they would unite in Greenland. Between Greenland and Spitsbergen there is 35° and as we go to the westward it would increase again. So I expect when at the Pole the needle will be about 55° west.

Mr. Chipman:—I asked the question because one of our leading members to-day in discussing this question said that possibly another magnetic pole might be discovered on the Siberian Coast, and in the region between the two there would be no variation or there would be such variation as to prevent any navigation.

Captain Bernier:—I think there are only two magnetic poles, which are the negative and the positive.

President Ross:—There are some local poles.

Captain Bernier:—A local pole is a place where there is no disturbance. There is one in the South Sea after you pass the Cape of Good Hope, and there you will find there is no magnetic error; and on the coast of Siberia it is an easterly variation all along the Coast. If you read the voyage of De Long you will find the variation was decreasing as they went west.

I consider there would be a very large area where the needle will be about 180 degrees, in the neighborhood of 70 degrees north latitude.

Mr. Chipman:—I think the Committee on Repository and Biography should be stirred up. We find this year there is no biographical sketch, a very serious omission. I think each year a great effort should be made. The Committee is now two years old and surely in that time we should be able to secure the

portrait and biographical sketch of some of the earlier Surveyors General.

Mr. Van Nostrand:—This matter has received a very great deal of attention from the members of the Executive, and so far as the members that are in charge and responsible for that work are concerned everything has been done to secure biographical sketches and photographs of each of the few Surveyors General whose biographical sketch and picture has not appeared; but it has been impossible to find even representatives of those who are remaining. My recollection is that Mr. Wyatt, Mr. Cameron and one or two others whose names I have in a list here, have, so far as we are concerned, passed out of history. Further than that even if we could find representatives of Surveyors General their number is so small that they would only last us for a few years, and then what shall we do? What shall follow this practice of publishing a biographical sketch of a Surveyor-General each year? This question should receive attention now.

Mr. Chipman:—I think there are a great many able Surveyors who have passed away whose portraits we now have in our collection and as soon as we exhaust the Surveyors General we could commence publishing the portraits and biographical sketches of the early Surveyors.

Mr. Walker:—I think it would add very much to the interest of the proceedings to have a biographical sketch in the proceedings each year. If we run short of dead subjects why not give a few living ones? The Canadian Society of Civil Engineers publishes each year a portrait of its president. I think this is a very good thing indeed, then, as has been stated here, it is very difficult sometimes to get a good likeness of men after they have passed away, but we can always get good ones of those who are still with us. For my part, I do not see why we should wait until men are dead before we put their pictures in our proceedings.

Mr. Chipman:—Has any member of the Association volunteered to accompany Captain Bernier?

The President:—I think he stated to me that several members of the Association had volunteered; but I do not know positively. There is no doubt before the Captain completes his staff of assistants and sailors he will have several applications from our members.

Mr. Chipman:—I am sorry there are not more of our members here to-day. We should treat this matter more seriously, and should give Captain Bernier more assistance. It is a laudable enterprise and well-worthy of our support. We must not look at it from a monetary point of view, altogether, though if I were a younger and a more robust man, I would not hesitate at all to go, for I believe there is money in it. As I stated to the committee this morning I understand that Lieut. Peary cleared \$40,000 one season after he returned. Many of us work a long time surveying before we do that. And Dr. Nansen has received over \$100,000 on royalties on his books alone for one year.

The President:—I have, no doubt, some of our members, who appreciate this work, and the value of it, and the money that is in it, will volunteer to accompany the Captain.

Mr. Dickson:—I do not know that we can do any more in the matter than to recommend that some members of the Association should volunteer. One thing I do feel satisfied about, that either on the expedition, on the platform, or anywhere else, the Ontario Land Surveyor can hold his own; his writings are instructive and interesting, and his calculations are as accurate as they are interesting; this Association should ask some member to volunteer to accompany Captain Bernier.

Mr. H. H. Gibson:—When does he intend to start for the Pole?

The President:—A year from next May, Captain Bernier desires to get one of our members who has had considerable experience in exploring on land in the Arctic regions. He is most anxious to have some member of this Association to accompany him. Before Dr. Nansen and Mr. Peary started, Mr. Chipman wrote to them and asked if they had an opening for one of our members.

Mr. Chipman:—Both were written to. Lieutenant Peary gave a definite answer. The volunteer, if I remember right, was requested to subscribe some hundreds of dollars towards the expedition.

Mr. Tyrrell:—No; Lieutenant Peary wrote asking the Association to have a member sent as a representative.

Mr. Chipman:—But when I wrote further, he said he was expected to contribute about \$500 for the privilege of going—some hundreds of dollars.

Mr. Tyrrell:—There is no salary?

Mr. Chipman:—No.

The President:—From what Captain Bernier told me, he expected a member of this Association going would have a salary equal to what he would have if he were working under the Department of the Interior.

Mr. Chipman:—If a member of the Association should volunteer, the Provincial Government might pay his salary while away? I do not think there would be any doubt about that.

The President:—Have you a resolution?

Mr. Chipman:—There is no need of a resolution. This matter should be brought before the members of the Association individually at an early day, before the proceedings are out; I think the Executive should take means to do so.

Mr. Tyrrell:—It would be well to have a small circular printed and sent to each member of the Association.

Mr. Chipman:—I will move that a circular respecting Captain Bernier's Polar Expedition be sent to all members at as early a date as possible, calling for volunteers to accompany the expedition, and at the same time outlining Captain Bernier's plan. This circular to include a copy of this resolution.

The President:—The Captain told me, he desired that any member volunteering should be approved by this Association as a body; or if no member of this Association would volunteer that we should select some one else, to represent us.

Mr. Tyrrell:—I have very much pleasure in seconding Mr. Chipman's motion.

The President put the motion and on a vote having been taken declared it carried.

Mr. Dickson: moved; seconded by Mr. Gibson, that the President, Mr. Ross, leave the chair and that Mr. Chipman take the same.

The Vice-President put the motion, and, on a vote having been taken, declared it carried.

The President left the chair, and Mr. Chipman took it.

Mr. Dickson:—I have much pleasure in moving that a cordial vote of thanks of this Association be given to Mr. Ross, our retiring President for the very gentlemanly and able manner in which he has presided over our deliberations.

Mr. C. A. Jones:—I have much pleasure in seconding that motion.

Mr. Chipman put the motion and on a vote having been taken, declared it carried.

Mr. Chipman tendered the vote of thanks to Mr. Ross, the retiring President.

Mr. Ross:—Gentlemen, I thank you most heartily. It has been a very great gratification to me to be President of this Association; and I consider it a very high honor conferred upon me. I was appointed Vice-President in the room of Mr. Foster, one of the greatest ornaments to the profession of Ontario Land Surveyors.

I think every member of this Association should aspire to hold this very high position. I am sure it would benefit any one to have that ambition. While I did hope to be President some day I was elected sooner than I expected to be.

I thank you gentlemen for the honor you have done me, the kindness and courtesy you have shown me and the good feeling that animated you in passing this resolution and tendering me the thanks of the Association. (Applause).

On motion of Mr. Dickson, seconded by Mr. Walker, the meeting adjourned, after singing the National Anthem.

PRESIDENT'S ADDRESS.

GENTLEMEN,—It gives me very much pleasure to have the honor of presiding at this, our first Annual Meeting in the new century, and welcome you to the sixteenth meeting of the Association, being the ninth, since the Act of Incorporation was passed. I am glad to note that the programme contains a good list of topics of interest to the majority of our members and, although there may not be so many papers to read, as on some previous occasions, there will be all the more time for discussion, and I have no doubt that this meeting will be a successful and profitable one.

It is gratifying to notice so good an attendance at the first session this year, as it augurs well for a full and regular attendance at all the sessions. There are at present 220 active members on the register, but only about one-fifth of our number usually attend the Annual Meetings, and an examination of the record shows that a very large percentage, if not the great majority, of the members never attend a meeting; never con-

tribute a paper, nor assist in the work of Committees. Since incorporation, the number of members attending the Annual Meeting has varied between 53 and 40; but the list of the names of members attending one year is very similar to a list of those attending any other year. A member attending one meeting usually looks forward with pleasure to the next, knowing that he is benefited by coming into contact and exchanging opinions with other members, and becomes a regular attendant and contributor. I do not suppose that any member prides himself on keeping aloof from our yearly gatherings, or in taking no part in the proceedings, or sighs for the old days in which there were no fees and no reports, therefore I venture to ask an additional number of members to become "active," in other respects than the mere payments of their fees. Members of our Association receive many benefits besides those conferred upon them by having legislation affecting their interests looked after, and unqualified intruders dealt with.

On the 22nd of January last, our beloved Queen died at Cowes, in the Isle of Wight, thus closing the longest and most illustrious reign of the world's greatest Empire. There are very few of our members who ever had, or can remember having any other sovereign; we have all taken the oath of allegiance to her, and can look back with pride and pleasure to having lived in the Victorian Era, in the reign of a queen who commanded the reverence and love of not only her own people, but the people of all lands. Her virtues and devotion have been a perpetual lesson and will remain an undying heritage. In the neighboring Republic, a land that once formed a part of the British realm, and that later fought against it in deadly strife, this granddaughter of George III. was mourned by rich and poor alike, and memorial services were held that were marked throughout by heartfelt sorrow. Thus she whose reign was crowded with victories, she who encouraged science, art, and literature, passes into history, followed by the affection of all the peoples of the earth." I recommend that a Committee be appointed to draw up and transmit through the proper channels, a suitable memorial showing the esteem and affection in which the Queen has always been held by the members of our Association, and the great loss her death has been to the Empire.

King Edward VII has commenced his reign, better qualified than any of his predecessors to fulfil the arduous duties devolving upon him, and will, without doubt, prove a worthy successor to his illustrious mother. As the Prince of Wales, he not only be-

came the most popular man in England, but won the esteem and affection of all, by his direct personal patronage of every charitable, beneficial, or scientific movement, and on taking the oath of accession, he said it would be his aim to work for the good and amelioration of his people.

I am sorry to have to announce that the hand of the reaper, death, has been at work among us during the past as on previous years, and has removed T. O. Bolger, (Kingston); D. B. Brown, (Cornwall); J. McCallum, (Fort Francis); J. M. Tiernan, (Tilbury Centre), and W. S. Davidson, (Sarnia). An extended reference to these members will be found in the obituary column.

It is with pleasure I note that the efforts of the Good Roads Association formed in 1894, is being crowned with success, and that many of the County Councils throughout the Province are taking steps to macadamize or permanently improve a network of main leading highways. This work is being fostered by the Government of Ontario, which will probably contribute one-third of the cost. If the condition of the roads is the measure of the character of a people, it is high time that the rural highways in this Province be put in a condition to reflect credit and not disgrace on an intelligent and progressive country. Many of our members will benefit by this improvement in at least being able to get back and forth from their operations in the field with greater ease and comfort, if not financially, in laying out and supervising the construction of the work.

During the past season several of our members have been engaged in exploring the northern part of this Province, and their reports will probably show vast tracts of mineral, timbered and agricultural lands. Extensive subdivision surveys may be looked for at an early date in this region, and when New Ontario is opened up by the projected railways, the hum of the pulp-mill, nickel and steel plants will be heard in the land.

The war in South Africa is now happily being brought to a successful close; a result to which Canada's sons contributed in no small measure. This war has shown to the world how firmly the bond of sympathy has been knit between the Mother Country and her colonies, and has also served to bring Canada and its resources prominently into the notice of Great Britain, which will no doubt be a means of stimulating the trade and commerce of this country.

I am happy to note that Canada is about to become prominent in Polar exploration, and that Captain Bernier, whom we have

present to-day, and who will address us on this subject to-morrow, has interested the Government of the Dominion in his proposed expedition to the North Pole, and is likely to set out with a suitable vessel, and the most modern equipment, at an early date. His work and progress will be watched with our hearty and active sympathy, and though he may not succeed where all others have failed, he will at least reflect honor and credit, not only on himself, but also on his country, and we hope he may have the supreme satisfaction of declaring the whole of the Pole as belonging to Canada by right of discovery.

GEO. ROSS,

President.

February 26th, 1901.

NOMINATION AND ELECTION OF OFFICERS.

The President called for nominations for the office of President for the ensuing year.

Mr. Kirkpatrick moved, seconded by Mr. Proudfoot, that Mr. James Dickson be president for the ensuing year.

There being no other nominations President Ross declared Mr. James Dickson duly elected President of the Association for the ensuing year.

President Ross called for nominations for the office of Vice-President.

Mr. Van Nostrand nominated Mr. W. R. Aylesworth of Belleville; seconded by Mr. C. A. Jones.

There being no other nominations the President declared Mr. W. R. Aylesworth of Belleville duly elected Vice-President for the current year.

President called for nominations for the office of Secretary-Treasurer.

Mr. Dickson nominated Mr. Villiers Sankey, of Toronto, for the office of Secretary-Treasurer; seconded by Mr. H. H. Gibson.

There being no other nominations the President declared Mr. Villiers Sankey duly elected Secretary-Treasurer for the current year.

The President called for nominations for the office of Auditor.

Mr. Walker nominated Mr. A. J. Van Nostrand, of Toronto, and Captain Gamble of Toronto, as the auditors; seconded by Mr. McDowall.

There being no other nominations, the President declared Messrs A. J. Van Nostrand and Captain Gamble duly elected as auditors for the current year.

The President called for nominations for members of Council.

The following nominations were handed in:

Mr. A. Loughheed, of Port Arthur, nominated by Mr. Proudfoot.

Mr. C. A. Jones, of Petrolea, nominated by Mr. Dickson.

Mr. John McAree, of Rat Portage, nominated by Mr. Van Nostrand.

Mr. C. J. Murphy, of Toronto, nominated by Mr. Kirkpatrick.

Mr. J. W. Tyrrell, of Hamilton, nominated by Mr. Walker.

The President appointed as scrutineers Messrs Esten and J. F. Whitson.

President Ross then introduced Mr. James Dickson, President elect, to the meeting.

Mr. Dickson:—Gentlemen: I thank you very kindly for the very high honor you have done me in electing me your President. I have been a member of the Council for one year, and Vice President during the past year, and during my connection with the Association as a member of the Committee and as an officer I have always been able to say that every member of the Association has given his most hearty co-operation and assistance to the office-bearers, and I feel sure that I can count on your assistance in the future as the other officers have in the past, and I know that you will do all in your power to aid me in the proper discharge of the duties of my office as President of the Ontario Land Surveyors' Association for the year 1901-2.

It was moved by Mr. Dickson, seconded by Mr. Walker, that the Secretary-treasurer be paid the sum of \$225 as a slight mark of appreciation on the part of the Association for his services as Secretary-treasurer last year. Carried.

Moved by Mr. Kirkpatrick, seconded by Mr. Dickson, that the Association has heard with deep regret of the loss by death of the following members of the profession since the last Annual Meeting of the Association: Walter Stanley Davidson, Joseph Martin Tiernan, Thomas O. Bolger and David Rose Brown and that a copy of this resolution be forwarded to each of the respective families of the deceased members. Carried.

Moved by Mr. H. H. Gibson, seconded by Mr. C. A. Jones, that any omissions or clerical errors in the records of this meeting now in the hands of the acting secretary and stenographer be corrected by the committee on publication before being printed. Carried.

Moved by Mr. Tyrrell, seconded by Mr. Walker, that a Committee on Polar Research be appointed by the Council. Carried.

Moved by Mr. Walker, seconded by Mr. Robertson, that a fee of \$5 be paid each of the auditors on completing their work of auditing the accounts of the past year. Carried.

Moved by Mr. Van Nostrand, seconded by Mr. H. H. Gibson, that the Council of Management be instructed to take up the question of the preparation of papers for the programme for the next Annual Meeting, and that this shall be a matter in which the Council has full responsibility, and that the members thereof be instructed and requested to see that the papers are forthcoming as required. Carried. Mr. Walker asked for information in regard to a paper by Mr. Wicksteed on Railway Work, which was ordered to be published in the proceedings of last year, but which does not appear.

Mr. Van Nostrand stated that the publication of the paper was authorized by the meeting; that the paper was taken as read, and directed to be printed in the proceedings, but the paper was not forwarded, and therefore could not be printed.

NOTE.

The following letters have been received from Ottawa in response to the Address of Condolence sent to His Majesty the King, which is given in fac-simile on page 29.



B

SECRETARY OF STATE, CANADA.

File No. 186.

Ottawa, 11th May, 1901.

Sir,

I have the honour to acknowledge the receipt of your letter of the 10th instant, advising of the transmission of a copy of a resolution passed by the Association of Ontario Land Surveyors, expressing condolence on the occasion of the death of Her late Majesty Queen Victoria, and praying that the reign of His Majesty King Edward the Seventh may be a long and happy one, and to state that the same has been forwarded through the proper channel to the end that it may be laid at the foot of the Throne.

I have the honour to be,

Sir,

Your obedient servant,

Joseph Pope.

Under-Secretary of State.

Villiers Sankey, Esq.,

Secretary-Treasurer,

The Association of Ontario Land Surveyors,
City Hall, Toronto, Ontario.



SECRETARY OF STATE, CANADA.

W.

No. 186.

Ottawa, 11th July, 1901.

Sir,

Following up a letter from this Department, dated the 11th of May last, I have the honour, by command of His Excellency the Governor-General, to convey to you, and through you to the members of the Association of Ontario Land Surveyors the grateful thanks of His Majesty The King for the sympathetic and loyal message forwarded with your letter of the 10th of May, 1901.

I have the honour to be,

Sir,

Your obedient servant,

P. Pelletier.

Acting-Under-Secretary of State

Villiers Sankey, Esq.,

Secretary-Treasurer,

Association of Ontario Land Surveyors,

City Hall, Toronto.

MEMBERS IN ATTENDANCE AT THE NINTH ANNUAL MEETING.

FEBRUARY 26TH, 27TH AND 28TH, 1901.

Geo. B. Abrey.	J. D. Evans.	James Robertson.
W. R. Aylsworth.	R. P. Fairbairn.	George Ross.
E. G. Barrow.	W. B. Ford.	V. Sankey.
David Beatty.	K. Gamble.	H. DeQ. Sewell.
C. D. Bowman.	J. Hutcheon.	W. V. Taylor.
H. J. Bowman.	C. A. Jones.	J. W. Tyrrell.
W. A. Browne.	G. B. Kirkpatrick.	A. J. VanNostrand.
M. J. Butler.	R. McDowall.	A. P. Walker.
Willis Chipman.	H. McGrandle.	J. W. Warren.
Allan Ross Davis.	W. A. McLean.	J. F. Whitson.
John Alton Davis.	C. J. Murphy.	Wm. Spry.
James Dickson.	H. B. Proudfoot.	L. B. Stewart.
H. L. Esten.	V. M. Roberts.	

RESULT OF ELECTIONS FOR 1901-1902.

President.....James Dickson.....(by acclamation).
Vice-PresidentW. R. Aylsworth.....(by acclamation).
Secretary-TreasurerVilliers Sankey.....(by acclamation).

Members of the Council of Management elected for the ensuing three years :

J. W. Tyrrell. John McAree.

Auditors for the ensuing year : (by acclamation).

Capt. Gamble. A. J. Van Nostrand.

I declare the above named officers elected.

VILLIERS SANKEY,
Secretary-Treasurer.

Certified correct.

J. F. WHITSON, }
H. L. ESTEN, } *Scrutineers of Ballots.*

Under Sec. 16, Chap. 180, R.S.O., 1897 the Council appointed Mr. C. A. Jones to fill the vacancy caused by the resignation of Mr. W. R. Aylsworth as member of the Council.—*Secretary.*

REPORT OF THE COUNCIL OF MANAGEMENT FOR THE YEAR 1900.

The Council during the year held its regular meetings as prescribed by the Statutes.

Mr. James Dickson having been appointed vice-president on the death of the late F. L. Foster, the Council, under Section 16 of the Act Respecting Land Surveyors, appointed John McAree, of Rat Portage, as member of the Council.

Messrs. B. J. Saunders and Maurice Gaviller were reappointed members of the Board of Examiners, their terms of office having expired. Mr. M. J. Butler's term of office, to which he was nominated by the Lieutenant Governor in Council, has just expired.

No By-laws were passed during the present year.

Progress has been made towards supplying a reliable Standard for Surveyors. The Secretary-Treasurer has been in correspondence with a firm and will bring the subject before the Association in a separate paper. Meanwhile it may be satisfactory to state to the Association that the Standard Bar in the custody of the Secretary of the Board of Examiners made by Messrs. Troughton and Simms, is probably the most reliable Standard in the Province to-day, it having been compared with the Standard in Great Britain, and also having been compared with the Standard in Ottawa, and its exact value given in an indenture, under the hand of the Commissioner of Standards at Ottawa.

As regards unlicensed practitioners, the Council has had under consideration, letters from several Surveyors and it has taken action on one and placed the matter in the hands of a legal firm for prosecution. This is a case in which it appears there ought to be no difficulty in obtaining a judgment, and it has been thought better to defer the others until this case has been decided.

Respectfully submitted,

GEO. B. KIRKPATRICK,

Chairman of Council.

Toronto, February 27th, 1901.

DISCUSSION.

Mr. Kirkpatrick:—The case referred to is one relating to an unlicensed practitioner. The Council of Management has in-

structed a firm of lawyers to take the matter up and prosecute him; and we are advised that we have a very good case.

Mr. Sankey:—The man referred to is named Poitvin, down east of Ottawa. The case is in the hands of a very well-known firm of lawyers in Ottawa, and I had a letter from them yesterday morning saying they have six instances in which the man has run lines and been paid for them. They feel perfectly convinced they can convict him. This is not the first time his name has been reported to the Association; he has been going on with this work for a long time, but he has always evaded the service of papers on him. But Mr. Lewis has taken the matter up and made personal efforts to find the exact details of what the man complained of has been doing. While in Ottawa I intend to see how far our solicitors have gone, and to urge them to go on with the case because there is no question we have a case now worth while taking up. The difficulty before was that Mr. Lewis and some others seemed to think the local Surveyors should be the prosecutors, and the local men did not wish to take that position. The moment I learned that was their difficulty I informed them that the Registrar of the Association was the proper person to take up the prosecution, and that the prosecution should be made in the name of the Association. A prosecution in the name of the Association would be much more effective than if it were in the name of an individual surveyor.

There is another case reported at Powassan, but we thought it would be advisable to wait till the result of the other prosecution became known and possibly then, having secured one conviction, the other one could more easily be effected.

REPORT OF THE BOARD OF EXAMINERS.

The following is the report of the Board of Examiners:

The Board of Examiners met at the office of the Hon. the Commissioner of Crown Lands, on Monday, February 11th, and the following days, as provided by statute. The following candidates passed the required examinations:

FINAL:

Jackson, James Herbert, city of Windsor.

PRELIMINARY:

Adams, Charles F., city of Brantford.

Code, Richard Stanley, Alvinston.

Greenlees, Alexander Hunter, city of London.

Brian, Michael Edward, city of Windsor.

Clark, Charles B., London township.

Bonds of the following Land Surveyors were approved and filed, in accordance with the provisions of the Act:

MacPherson, Charles Wilfrid.

McNaughton, Finlay Donald.

Stull, William Walter.

Fairchild, William Howard.

Shaw, John Henry.

Weeks, Melville Bell.

The following Articles were filed by the undernamed pupils with the undernamed masters:

NAME OF PUPIL.	NAME OF SURVEYOR.	RESIDENCE.	DATE OF ARTICLES.	TERMS.
Clark, L. O.	Farncourt, F. W. ..	London, Ont. ..	Feb. 16, 1900	Three yrs.
MacCallum, A. J. ..	Robinson, T. J.	Barrie, Ont.	May 15, 1900	One year.
Russel, W. B.	Shaw, J. H.	North Bay, Ont.	June 25, 1900	One year.
Holcroft, H. S.	Speight & Van Nos- trand	Toronto, Ont. ...	May 17, 1900	One year.
Law, E. H.	DeMorest & Sylvester	Sudbury, Ont. .	Jan. 17, 1900	One year.
Bray, L. T.	Bowmay, H. J.	Berlin, Ont.	Sept. 1, 1900	One year.
Anderson, W. B.	Wilde, J. A.	Sault Ste. Marie	Nov. 24, 1900	One year.

In the case of Mr. Holcroft, the Board of Examiners, under the provisions of Sec. 29, R.S.O.C. 180, allowed him to make a break in his term of service, in order to take a post-graduate course at the School of Practical Science.

Respectfully submitted,

GEORGE B. KIRKPATRICK.

Chairman of Board.

Toronto, February 27, 1901.

Moved by Mr. Kirkpatrick, seconded by Mr. Dickson, that the report be received and adopted. Carried.

SECRETARY-TREASURER'S REPORT.

DISCUSSION.

Mr. Dickson moved, seconded by Mr. John Davis, that Mr. Van Nostrand be appointed as auditor in the place of Mr. H. J. Browne. Carried.

Mr. Sankey:—The general tenor of the report is almost identical with that of last year; so many fees paid and the accounts have all been passed by the Council. It is simply a matter of putting the accounts into a list. There has been no extra expense this year except the publication of the Manual, which cost us about \$180 for printing and binding. As you will remember, the Manual was distributed early in the season. The expenses of the Council have been about the same as last year; and the expense of the Board of Examiners something less than last year. The fees are practically paid up as well this year as they were last year, but some few members are in arrears for several years. However, other members who had been seriously in arrears have been able to send their money in. Taking one thing with another we are in about the same position as last year.

Mr. Gibson:—How does the balance stand now ?

Mr. Sankey:—Roughly speaking, two or three hundred dollars to the credit of the current account.

President Ross:—And what is the amount in the Savings Bank ?

Mr. Sankey:—We had to draw from the Savings Bank in the early part of the year to pay for the Manual; and, you may remember, there was a grant made to the patriotic fund last year which took the cash out of the treasury in the early part of the year. But now, the fees in the last three or four months have been coming in most satisfactorily, and in cases which I really despaired of I have been very pleased to get bank drafts for a considerable amount of money from certain members who find it is in their interest to be paid-up members of the Association.

Mr. John Davis:—I would like to ask why it is that the report of our Proceedings is so long in appearing. I notice it is in the neighborhood of Christmas before we get the report, and that seems to me to be an extraordinarily long time for the printing of a document like ours. Perhaps there is some reason.

Mr. Sankey:—The difficulty we experienced this year was largely due to the long time it took to get the proofs of some of the papers corrected by the gentlemen who contributed the papers. Some of the papers had to be sent to the men who wrote them but who were not present at the meeting, and it took them a long time to send them back to us. One of the papers had to be recast before being printed. And the printers delayed me five or six weeks; I did not get the reports from them till October; and then we commenced sending them out. I know a great many were posted in October and November and some gentlemen here to-day say they have not yet got them. This was to me the first intimation that they had not been received by those to whom they were sent. The only way I can account for it is that the wrappers were torn off. I am informed that in the Hamilton Post Office several were found without the wrapper on, although I had used the same wrapper as has been used heretofore. I do not know whether that was because of the rougher handling they received; but to provide against the possibility of that I have now adopted a heavier wrapper. Being new to the business I did not know how close

one has to watch printers, and authors of papers and everything else in order to get the thing out in proper shape. Another year it will not take me so long.

While speaking on this matter I would say that it is only in the last three weeks I have received any more of our exchanges from the States. In fact three of them came during the week of the meeting of our Board of Examiners, and they are up now in our Repository ready for mailing. The people on the other side of the Line, with whom we exchange, seem to have had the same kind of delay we have had.

President Ross instructed the Secretary, Mr. Sankey, to send his report on to the Chairman of the Council.

REPORT OF COMMITTEE ON REPOSITORY AND BIOGRAPHY.

MR. PRESIDENT.—Your Committee on Repository and Biography, beg leave to report as follows:—

As foreshadowed in the report of this committee for the preceding year, the change of rooms for the use of the Board of Examiners and the Association has been made, and the great improvement in our accommodation is too evident to require notice, further than as recognition of the generous treatment we have received at the hands of the Honorable, the Commissioner of Public Works. In addition to the advantages for the purpose of meeting, the three rooms now under our control are available for committee meetings, and for the use of individual members, who have occasion to copy plans, etc., of record in the Department of Crown Lands.

It is expected that during the coming year, further improvement will be made in this direction.

A considerable number of additions have been made to the number of works in the library, and a new catalogue will shortly be required.

The Biographical section of the committee has now more or less complete sketches of the following Surveyors:

Mahlon Burwell, Milton C. Schofield, John Farquharson, Richard Birdsall, E. C. Caddy, Aaron Greely, D. O'Reilly, Samuel Ryckman, Peter Carroll, John S. Aylesworth, J. D. McNabb, P. N. Hyndman, William Robinson, Samuel S. Willmott, J. Nepean Molesworth,, David Gibson, John A. Tidy, Thos. W. Walsh, Eliakim Malcolm, Jas. Kirkpatrick, Augustus Jones, John McDonald, J. Stoughton Dennis, William Campbell, Henry Strange, Thos. A. Blythe, Hugh McMahon, John Stigman, Robert Synee, Charles Rankin, T. C. Keefer, E. De Cew, Hugh Black, Henry Ewing, S. M. Burson, J. M. O. Cromwell, Hon. A. Yidal, H. DeQ. Sewell, Francis Bolger, C. J. Wheelock, Jos. Kirk.

Some of these sketches are complete, whilst others are mere outlines. It has been suggested that with the above list in printed form, additions may be made by members who can recall incidents in the lives of many of those enumerated, and thus add to the collection of data.

An interesting collection of photographs has been begun, and your Committee would take this opportunity to solicit contributions of biographical sketches and photographs of members who have not already accepted previous similar invitations.

Respectfully submitted,

A. J. VAN NOSTRAND.

Chairman.

REPORT OF PUBLICATION COMMITTEE.

MR. PRESIDENT,—Although your Committee commenced their labors soon after the Annual Meeting, our Report was not published as soon as we expected. There was considerable delay in the correction of the "proofs" of some of the "papers," as the whereabouts of the authors was difficult to obtain; and a good deal of time was taken up in redrafting nearly all the illustrations.

We were unable to obtain a suitable biographical sketch for publication.

1,350 copies of the report were satisfactorily printed by Messrs. Henderson & Co., at a cost of \$374.42.

We desire to call the attention of the members of the Association to our advertisements.

We exchanged Reports with the following Societies:

School of Practical Science Engineering Society	150
Michigan Engineering Society	125
Ohio Society of Surveyors and Civil Engineers	125
Illinois Society of Engineers and Surveyors	135
Indiana Engineering Society	100
Iowa Civil Engineers' and Surveyors' Society	85
Wisconsin Engineering Society	
Purdue Society of Civil Engineers	

Respectfully submitted,

KILLALY GAMBLE

Chairman.

February 27th, 1901.

REPORT OF THE COMMITTEE ON LAND SURVEYING.

MR. PRESIDENT,—Your Committee on Surveying have nothing special to report this year.

Six papers, containing questions, have been under the consideration of the Committee, and they beg to submit the following conclusions; for your examination and adoption or amendment.

Your Committee also considered Mr. John McAree's communication on the subject of an "Ontario Manual of Surveys," and beg to recommend that the same be referred to the Council with a request that the Council will take action thereon, and have Mr. McAree's ideas carried out if possible.

All of which is respectfully submitted,

WM. R. AYLSWORTH

Chairman.

Feb. 27, 1901.

QUESTION DRAWER.

Ottawa, February 21st, 1901.

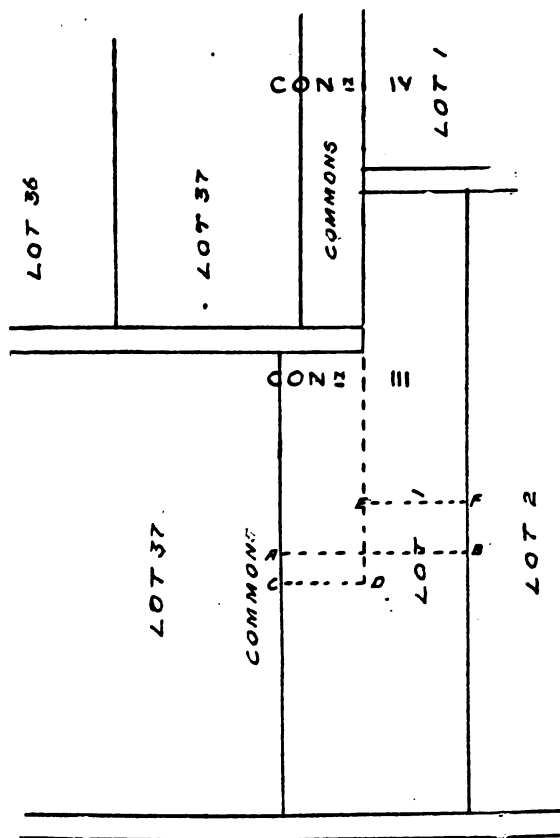
MR. V. SANKEY:—

Dear Sir,—I regret to say that I shall be unable to attend the O. L. S., annual meeting next week but I enclose a question which came up in my practice a couple of months ago. I would like to have the answer of the Surveying Committee at as early a date as possible, and would consider it a favor if you will attend to it for me.

Thanking you in anticipation,

I am yours very truly,

A. J. McPherson.



The above diagram shows the boundaries of Lot I in the 3rd Con., of a single front concession Township in Ontario.

How would the dividing line between the north and south halves be run ?

Would it be as shown at A B, or C D E F, C and F being the middle points of the side-lines of the lot ?

Ans.—Draw line A B on a mean course between the north and south ends of the lot so as to divide the lot into two equal parts.

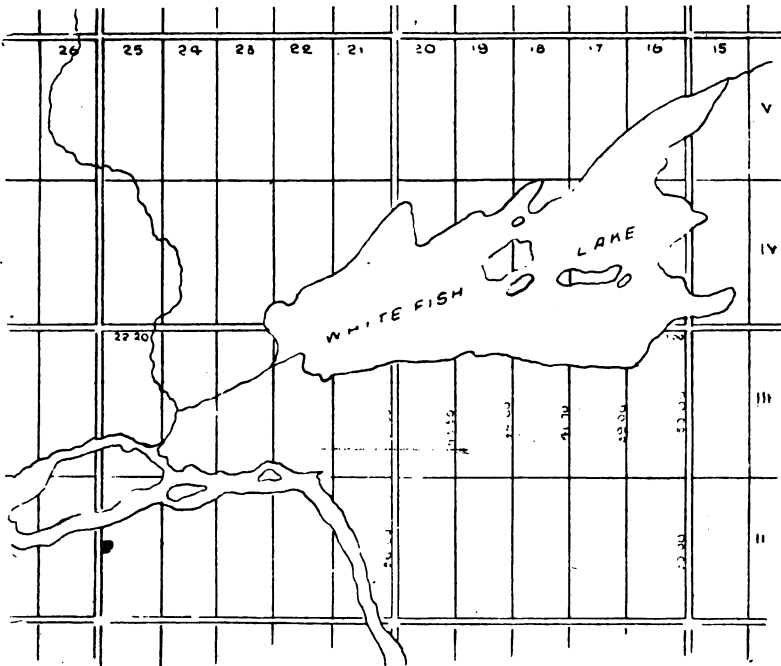
Eganville, February 23rd, 1901.

W. R. Aylesworth, Esq., O. L. S.,

Chairman Committee on Question Drawer.

Dear Sir,—I enclose Sketch of part of Township of Brougham, surveyed 1871, Sectional system.

On the ground I found line between lots 15 and 16, where it was intersected by line between Concession III and IV, I traced both lines for a considerable distance, but found that instead of it being seven chains on concession line, and two chains on side-line from roads to water as shown in Field Notes, the distances on ground were about 14 chains and $8\frac{1}{2}$ chains re-



spectively. From Field Notes it is doubtful whether posts were planted on south side of Whitefish Lake, though the inference is they were, and one old settler says he saw one of them, *i.e.*, between 16 and 17. I want to know how you would proceed to run lines between lots 16 to

20 inclusive and to establish blind line between concessions II and III in this block. The old posts at intersections of Road allowances between concessions III and IV, lots 25 and 26 are standing; no other posts can be found between these and intersection of concession with line between 15 and 16. I found width of lots 16, 17, 18, 19, 20, 21, 22, 23, 24 and 25 to be 200 chains .04 links, instead of 204 chains .60 links, as shown by Field Notes.

There is not any allowance for road around Whitefish Lake.

Trusting that this is not too late to receive attention of your committee, I remain,

Yours truly,

HERBERT J. BEATTY.

ANS.—1. Connect points or posts that can be found on concession-line, 3rd and 4th concessions east and west of Whitefish Lake by a straight line; and points on side-road line 20 and 21, south and north of Lake by another straight line, measure distance from intersection of said lines to line of side-road 15 and 16, deduct half width of side-road and divide remainder of distance proportionally into five lots:

2. Divide distance from said intersection on line 20 and 21, to line 1st and 2nd concessions equally, also divide length of 2nd and 3rd concessions on line 15 and 16 equally, and then draw straight line between these middle points from rear of 2nd concession lots.

NO. 3.

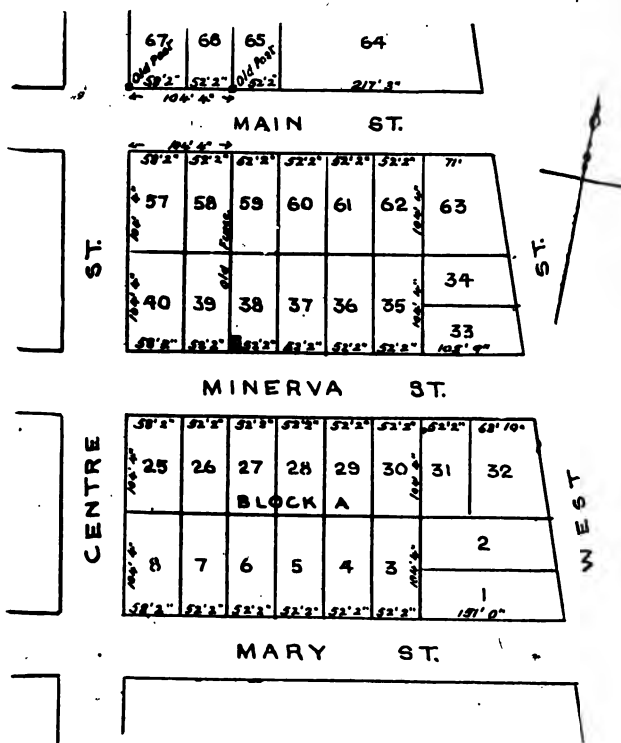
Huntsville, Ont., February 5th, 1901.

The accompanying plan shows part of the Town of Huntsville, surveyed in June 1876 and plan registered on the 22nd August of same year. The said plan shows the lots adjoining the east side of Centre Street to have a frontage of 58 feet 2 inches, and all the other full lots a frontage of 52 feet 2 inches. There is an old post between lots 65 and 66, an old fence between lots 58 and 59, and there was a stable erected in August 1876, on the south-west corner of lot 38, leaving a distance of 104 feet 4 inches between each of said land-marks and the east

limit of Centre Street. How should the lines between lots 39 and 40, lots 57 and 58, and lots 66 and 67 be established?

How should lines between lots in Block A be established? No old land-marks being found.

HUGH McGRANDLE.



ANS.—1. Give each lot 66 and 67, its proportion according to Field Notes of whole width on ground of both lots.

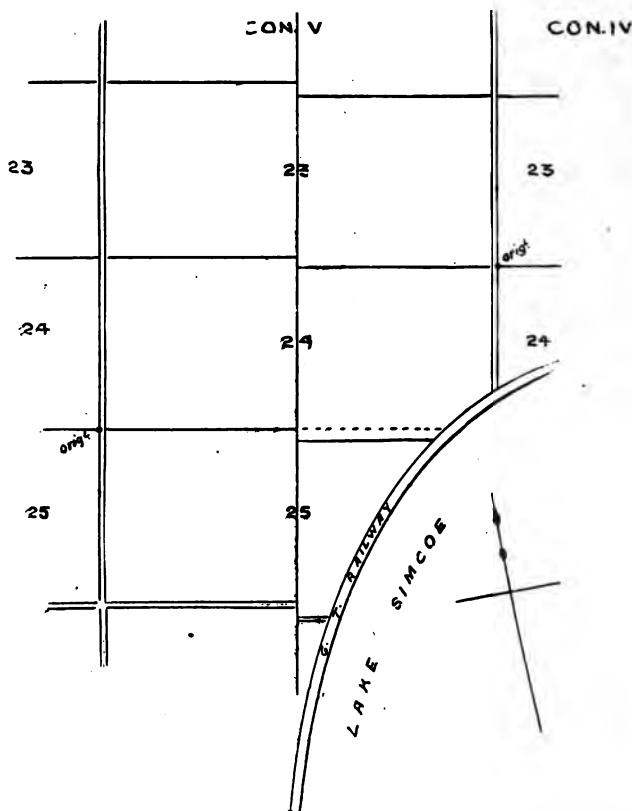
2. Find point on south side of Main Street between lots 58 and 59 from original post 65 and 66 on north side of Main Street, and give 58 and 57 each its proportion of width on ground. (Vide. section 37 and sub-section 2).

3. The old stable without further evidence is not sufficient to establish that corner.

Collingwood, August 21st, 1900.

P. S. Gibson, Esq., O. L. S., Willowdale, Ont.

Dear Mr. Gibson,—I have a question of boundary on hand, on which I would like to get your opinion, as I have not got the dates of the old amendments to the Survey Act.



The case is as follows:

In 1838 the boundary between the east halves of lots 24 and 25, concession V (see diagram enclosed), was fixed giving a jog on the blind line of concession V.

This survey was confirmed by H. P. Savigny, P. L. S., in 1854, and it appears also by Gibbard and Robt. Ross, P. L. S's. In 1872 or 3, when determining titles for the Muskoka Extension Railway, P. L. S., A. C. Thompson, in conformity with Section

31 Survey Act, ran a line from the post in *Rear* straight through to the lake leaving no jogs.

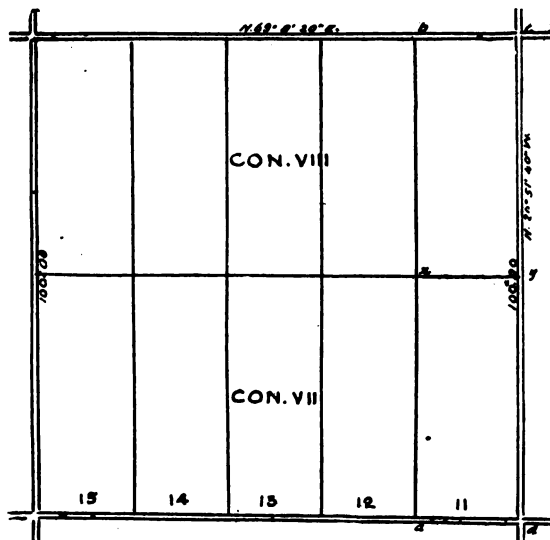
Qu.—Was there anything to permit the first survey giving jog in the centre of the concession?

We want the matter settled without law-suit.

Yours sincerely,

M. GAVILLER.

Ans.—Line should be run from rear of 5th concession straight to the lake. (See last part of Section 31).



No. 6.

Sudbury, Ont., January 22nd, 1901.

W. R. Aylesworth, Esq., O. L. S., Belleville,

Chairman L. S. Committee, O. L. S. Association.

Dear Sir,—I herewith submit a question for discussion by your Committee.

How would you run the rear line of any or of all the lots in this block?

This is in a Township mentioned in (Sec. 28, sub. 2), wherein it is enacted that all lines must be run on the astronomic bearing as shown in original Field Notes.

It has been my practice so far to run rear lines on a course to intersect side lines of lots in the middle, presuming that Sec. 28 (2) only refers to side lines of lots, but I do not see that the section covers this.

Yours truly,

L. V. RORKE.

Ans.—We think Sec. 28, S.S. 2, only refers to side-lines of lots—and rear line of lot No. 11 in 7th concession, should be run, if original Field Notes show that to have been the intention, from middle point on c. d, to middle point on a. b. (Vide Sec. 34).

REPORT OF COMMITTEE ON DRAINAGE.

Mr. C. A. Jones:—Mr. President, and Members of the Association, Mr. Code, the Chairman of the Committee on drainage, is not present to-day, and in his absence the Secretary has asked me to read the report.

Mr. C. A. Jones reads the report as follows:—

TO THE ASSOCIATION OF ONTARIO LAND SURVEYORS:

Gentlemen,—That the work of drainage has not diminished during the past year, and that litigation has not decreased, appears to be the conclusion of a number of members of this profession, whose practice is composed largely of drainage work.

It would involve considerable labor to review the drainage works of importance and decisions respecting drainage cases, and it has been before suggested that the reports and decisions on drainage cases might be published at nominal expense, by the Provincial Government, in which suggestion many concur.

The provisions of The Drainage Act are being gradually defined by decisions of the courts, but the enormous cost of such, suggests that some change should be made in the procedure, upon which final decisions are given.

The main questions as to usual, "Benefit," "Outlet Liability," and "Injuring Liability,"—and of note among opinions expressed in cases decided in the past year is contained in "Notes for Judgment of the Court, delivered by Gwynne, J., *re* Sutherland Innis Co., v, Romney." an appeal from a judgment of the Court of Appeal, of Ontario, affirming a judgment of the High Court, dismissing an action instituted by the appellants, in which the learned Justice states:

"Then in Sec. 3, sub-section 5, is enacted, the mode by which the amount to be charged to each particular lot to be assessed is to be determined.

A careful consideration of the Act therefore condemns, in my judgment, as wholly inadmissible, a construction which should hold that lands not benefited by a drainage work constructed under the provisions of the Act, are nevertheless made liable to assessment, for "Injuring Liability," or "Outlet Liability,"—notwithstanding the words in the third section, purporting to authorize the Engineer, to make an assessment of the lands and roads within said area, to be benefited, and of any other lands and roads liable to assessment as hereinafter provided. The provisions coming under the term "as hereinafter provided," seem, I think, to favor rather the construction that what the Legislature intended was, to provide in the interest of the persons to be assessed, that the sums should shew the nature of each item charged separately, as follows:—First, for "Benefit," meaning I apprehend thereby, (for no interpretation is given to this word in the Act), the benefit conferred by the facility for the drainage of all lands within the area of the drainage work; which benefit would vary according to the difference of elevation of the respective lots:—the quantity of water to be drained from each; the distance of the several lots from the drainage work, and the like.

Secondly:—For "Injuring Liability," that is to say for the special charge to each lot from which water is caused to flow to the injury of other lands in the manner described in the Act, under definition of "Injuring Liability." The whole cost of that work, in so far as it relates to the removal of this water is to be borne specially by an assessment upon the lots for which the water doing injury is so caused to flow.

Thirdly:—For “Outlet Liability,” which is only authorized to be assessed for in the one particular case of a drain constructed in one Township being continued into another until a sufficient outlet for the waters coming down such drain is reached.

The application of the same precise mode for determining the amounts chargeable for “Injuring Liability” and for “Outlet Liability,”—does not appear to be, I think, quite felicitous. The best mode of applying that sub-section to “Outlet Liability” would seem to be, first—to determine the total amount chargeable for “Outlet Liability,” by a calculation based upon the volume in which, and the speed at which the water comes down the drain to its outlet in another Municipality, than that in which the drain is initiated, and secondly; to apportion that sum among the several lots from which the water is caused to flow by artificial means from the lands assessable into the drains upon a calculation, based upon the volume in which, and the speed at which such waters are respectively so caused to flow into the drain. In any case all lands from which no water is so caused to flow into a drain, having its outlet in another Municipality than that in which the drain was initiated, would be exempt from assessment.”

To compile a report to agree with the enactment of the Drainage Act, with the various interpretations placed upon such by the different courts is a work requiring considerable ability and the necessity of a personal inspection of each particular parcel is apparent from decisions on appeals to the Drainage Referee, and the Higher Courts.

Work under the Ditches and Watercourses Act is apparently in no better condition than formerly to judge from the opinions expressed by members.

Some time ago, Sec., 28 of this Act, relating to the non-completion of work was amended by inserting the clause, “or at any time, not later than six months after the time fixed for the completion of the ditch.”

The working of the entire Act is blocked by this insertion, after the time limited has expired, and the Engineer has no authority to let the uncompleted parts, and the only course clear is a new award with its attendant risks.

An extension of time should be made, or the clause omitted entirely.

Though it is evident, we will not see changes effected until

after extensive litigation, it is still wise to work under Acts as they are, and to follow carefully the decisions of the courts relating to the various sections.

A. S. CODE,

Chairman of Committee on Drainage.

February, 27th, 1901.

DISCUSSION.

Mr. Sankey:—The case referred to in that report is the Sutherland Innis Company, plaintiffs, against the Township of Romney, and is reported in volume 30 of the Supreme Court of Canada Reports; this was an appeal from the Court of Appeal of Ontario. The report of the judgment commences at page 495 and concludes at page 535.

Mr. Jones:—Mr. Sankey has suggested having a number of copies of this report struck off in typewriting and sent to those who are most interested in drainage matters and ask them to send in their opinions or suggestions in regard to it.

Mr. Aylesworth:—I think if the case were cited in the Committee's report that those interested could get access to the law libraries and see the report as it is published in the Official Court Reports.

Mr. Sankey:—I was going to suggest getting five or six typewritten copies, which would not be a very expensive matter; and they could be forwarded in the form of a circular letter to those members of our Association who are more intimately connected with drainage, and each one asked to send in a small digest of his ideas, and to say whether in his opinion it would be interesting to the members at large to have this printed or to have a digest of it in our annual report. Of course the case would be cited any way; but possibly it might be difficult for some members to get hold of these Supreme Court Reports; in the large towns and cities they could be got at, but in the country it would be more difficult. I think it would be a little work for the new Drainage Committee to tackle in the early stages of their year if they were to give us a digest on the matter for publication in our next annual report.

The President:—It would not cost much more to print the whole report in full, than to make typewritten copies, and if printed in full it could be sent out to all our members.

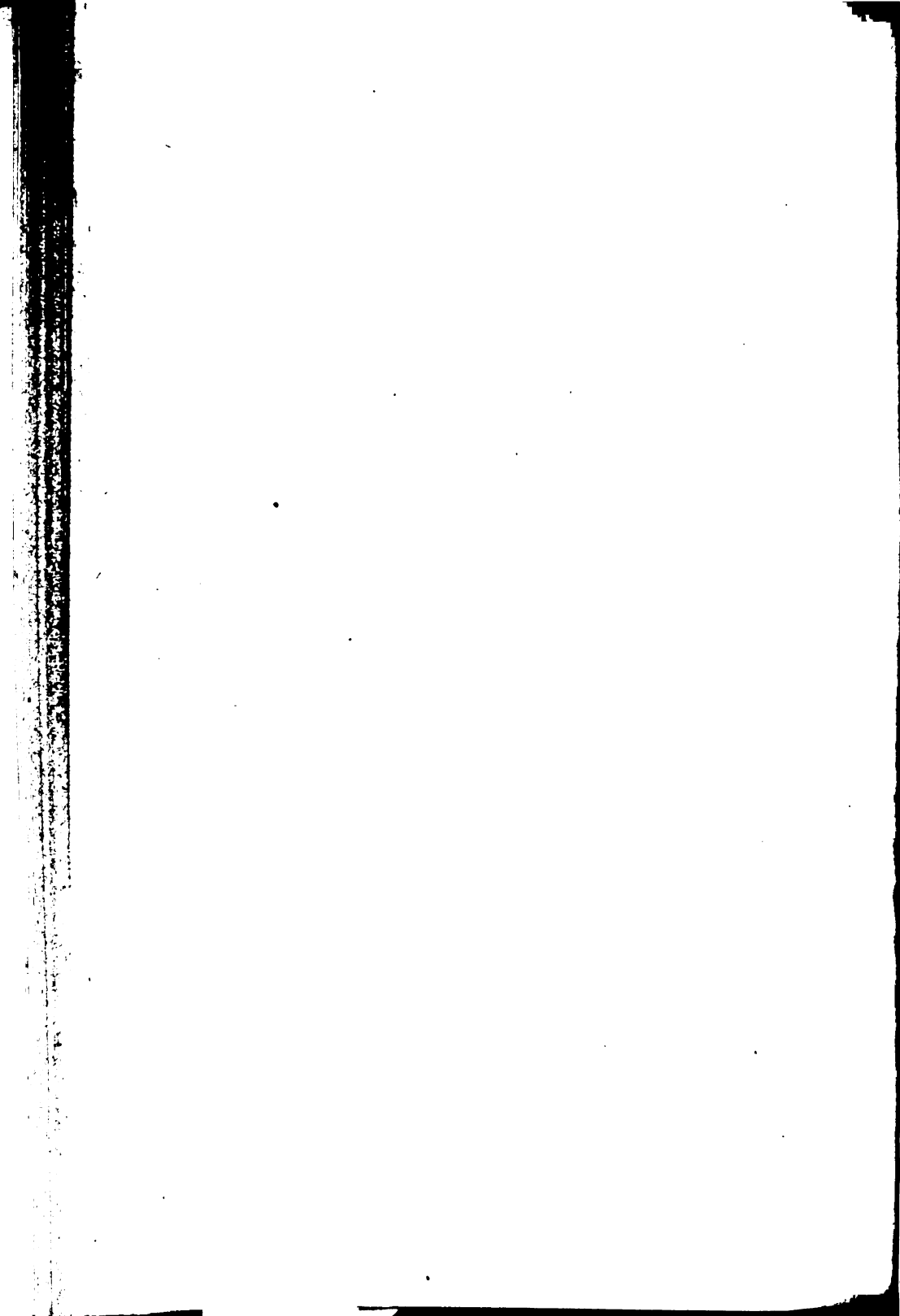
Mr. Sankey:—Several members are not interested in drainage at all. If we sent it to the drainage men, those most interested, six copies would go a long way; and if they would send us a digest on the result, I think we would get up a very useful addition to our next year's proceedings.

The President:—Almost every member is liable to have drainage cases.

Mr. Sankey:—Just printing that without any remarks would not be of as much use as if we had the opinions of men qualified to give opinions on the matter, and then publish the whole thing together. Still, if the Association desires to publish the whole of it, the expense does not amount to a great deal, and a matter of expense should not deter us from doing it.

Mr. John Davis:—Would it not be better to refer it to the Drainage Committee and let them prepare a digest of it?

Moved by Mr. John Davis, seconded by Mr. Evans, that the report of the Drainage Committee be received and printed in the Minutes; and that the Drainage Committee be asked to prepare a digest of the case cited in the Committee's report which should also be printed in the Annual Report. Carried.



DISCUSSIONS.

STANDARD OF MEASURE.

Mr. Sankey:—I see that Mr. M. J. Butler is in the room. I had hoped that he would have been here this morning to hear what was said with regard to the standard of measure. We have a few minutes yet before the time for hearing Captain Bernier's lecture, and I would suggest that the time be filled in by a few remarks from Mr. Butler.

Before I take my seat I would like to say in reference to the proposed Standard which was presented, and which is in feet and 10ths, and links and 10ths, that a member of the Association suggested that before this Standard would be worn out, or before the value of it would have been earned by the surveyor who had it, the metric system would probably be adopted, and that we must not be too quick in adopting the old-fashioned Standard. I make these remarks because I know that Mr. Butler has a good many ideas on matters of this kind.

Mr. Butler:—I had intended on the discussion to touch upon the origin of the British Standard, and to show the manner in which it was fixed. But Mr. Sankey suggests that I just deal for a moment with the metric system, as distinguished from ours. Some years ago—in 1885—there was a paper laid before the Institute of Civil Engineers in England, by which it was sought to show the advantages of the metric system, and the disadvantages in the way of loss and trade those using the British and English measures throughout the world were suffering from because of their failure to adopt the metric system. At that time I had no personal experience in the matter, except in a little way, from an academical standpoint; and it did seem to me the criticisms of those who were in favor of retaining the English system were simply evidences of the conservatism of Englishmen and that hundreds were more in favor of the metric; but since that time I have had some work to do under the metric system, and I found it involved a good deal of calculation; and as a result

of that experience I am not in favor of the general application of the metric system to engineering contracts. The changes that would be involved are so great as to practically render the whole of our accumulated engineering literature valueless. That in itself is a very serious matter. I do not think there is a lathe, or a screw or a bolt or a single one of the essential elements that go to make up a machine, or a bridge, that could be converted from the one measure into the other. We would simply have to abandon our present standard of measure, and by using perhaps data that is accumulated for a convertible unit, start all over afresh and not attempt to make use of conversion tables. It is a delusion and a snare to think you can take a conversion table and fit the English system into the metric or vice versa. The difficulties are such as would overwhelm a man even to attempt.

Besides this, I think in the training of the mind one of the most valuable things a man can learn is to use mental arithmetic well, but most men who attempt to multiply two or three decimals together mentally will find out they cannot do it. If you attempt to multiply $\frac{1}{8}$ by $\frac{1}{8}$ in the decimal system you have .15625 and so on, and who can multiply these mentally?

I think the remarks I have to make are better stated by Sir Frederick Bramwell who discussed the question before the Society; and as the discussion only occupied a few pages I will just read to you what he says: "Sir Frederick Bramwell, President, said he wished, before the close of the meeting, to ask the indulgence of the members for 0.0833, or it might be 0.1666 of an hour. What was the object of a system of arithmetic? He supposed that it was to be able to make calculations in the easiest manner, and to arrive at sufficiently accurate results.

That is just the point here. I think that one of the most sensible things an engineer can learn is to learn within what limits a measure is reliable. One of the first things he wants to do is to drop three or four places of decimals. The metric system has a tendency to make him go to, not three or four but ten or twelve. I think any finely subdivided recurring decimal of this kind is something we should try to get away from.

"The question, therefore, was whether the system in use in England, or that in use on the Continent, was the more likely to satisfy these conditions. He felt inclined to say, from many years' consideration and experience, that the English system was the more likely to give this satisfaction. Of course a mere

statement of opinion, if unsupported by facts, was of no value, and he therefore desired to give one or two reasons for the faith that was in him. He wished to be allowed to use the decimal system with English weights and measures when he liked, and to use vulgar fractions when he liked. At the present time the metric system was permissive in England, so that any one could use it when he pleased; but he presumed that the object of the author was to have an Act—a compulsory Act—which should forbid the use of the present English weights and measures. What would be thought by the advocates of the metric system, if those who preferred English weights and measures were to introduce a Bill for the purpose of prohibiting the metric and the decimal method. They would, no doubt, look upon such a measure as being very wrong and improper, and he must be permitted, on the other hand, to regard the introduction of the Bill to compel the use of the metric system as being equally wrong and improper. His hearers must not suppose that the advocates of the metric system were not amenable to the charge of seeking to make the continual use of the existing system a crime. The Bill brought in by Messrs. Ewart, Bazley, Baines, Smith and Graves, on the 24th of February, 1868, contained the following penal clauses:—

Then it went on to recite that the metric system must be used, under a penalty and forfeiture of the price if the English system was used.

“There must indeed be an extreme superciliousness of one system over the other, to justify an enactment that would cause a man to be considered a breaker of the law and liable to penalty simply because he chose to make his calculations by the old method instead of the new one. All that he asked was, that liberty should be left to people to make their own selection, and he thought if that liberty were continued it would be easy to foretell the result. The permission to use the metric system as a legal measure had existed in England for some years, and in the United States for a still greater number of years, but it had not been adopted; whereupon the advocates of the metric system, not content with leaving it to the selection of the people to use that which was most convenient, wanted to force their particular mode upon them by means of penalties. To come now to a consideration of the relative advantages of the two systems.

4)4385.134

7)1096.283

4)156.611

20)39.152

1.957 ton.

That example on Page 44 shows a little more in favor of the metric system in the calculation as the author reduced it to decimals and that makes the English calculation look a very large one and the metric one a very small one; but it will illustrate the point which Sir Frederick Bramwell makes. He says, "Some years ago he went into the workshops of the Paris and Lyons Railway, where he was shown a drawing of a locomotive, with a variable blast-pipe, and he asked what was the maximum and what the minimum area. One of the engineers took a sheet of foolscap, covered it with figures from top to bottom, and then gave him a dimension rather bigger than that of the cylinder. Sir Frederick Bramwell had a two-foot rule in his pocket, and, finding that the drawing was made on the scale of one-tenth, he applied the English inch tenth, and so got out the area and translated it into French measures, which he did in one-fifth part of the time occupied by the man figuring on the paper. He did not displace the decimal point, because he had not got one. Reverting to the calculations on the wall, he wished to show how utterly misleading they were. The Author had placed before the members two comparative calculations, employed to ascertain the weight in tons and decimals of tons of the water contained in a given sized vessel. In consequence of the bulk of water representing the weight in French measures he was enabled to stop in his calculation on arriving at the cubic contents, and to say, "The whole thing is done; there is the weight of the water; but if you do it in English measurements you will have all these additional figures to use before you can get the weight of the water." Assume for the moment the difference in the length of the two calculations existed, what did it prove as regard the general question? Nothing whatever. To what did it apply? To fresh water at a particular temperature, and to nothing else. There was no other liquid on the face of the earth, from ether to mercury, for which it would be true. It was not true for salt water, nor would it even do for fresh water at a different temperature. In any other case a multiplier must

be used to get the weight, which would make the metric calculation as complex as the Author's English example. But who but one whose mind was warped by the metric system would have thought of turning inches into decimals of feet prior to calculation. Would not any one else have worked the sum thus—?"

And then he works it out by the duodecimal system as follows:—

$$\begin{array}{r}
 10.6 \\
 6.2 \\
 \hline
 63.0 \\
 1.9 \\
 \hline
 64.9 \\
 1.1 \\
 \hline
 64.9 \\
 \hline
 5.4.9 \\
 \hline
 70.1.9
 \end{array}$$

"Let any one go to a French railway station, and ask for three tickets from A to B, and it would generally be found that the man (or, as was commonly the case, a woman with a man to look after her) could not tell the amount without taking a piece of chalk or a pencil and making a calculation. The clerk would have no more idea of what three times the single fare was than a child would have. Compare such a person's power of calculation with that of an English butcher's wife or daughter who was in the habit of dealing with pounds and ounces and pence. Let him test the question nearer home. Could many of those present mentally square 3.25 ? He believed very few. But there was no difficulty in squaring $3\frac{1}{4} = 10\ 9-16$. $10\ 9-16$ was a sum easily appreciated and easily expressed, while 10.5625 , the decimal equivalent of the vulgar fraction was much more cumbrous, and he ventured to think did not form any impression on the mind, except that it was a little more than one half. Again, which of them could square 4.125 ? That to the majority would be almost impossible, but with $4\frac{1}{8}$ there was no difficulty. $17\ 1-64$ compared with 17.015625 . It appeared to him that a system like the present one, which enabled mental calcu-

lations to be made rapidly and accurately, was enough for all practical purposes. . . . Water had been referred to as an instance of the wonderful use of the metric system. He would take a water illustration of a simple calculation by the English system. If engineers wanted to know how much a pump would lift, what did they do? They squared the diameter and multiplied by the stroke of the piston in yards, and at once obtained the amount in pounds, as every yard upon the circular inch was a pound. Taking an 8-inch pump, the square was 64; it was making 10 yards a minute—64 gallons a minute—there they had it in a moment. Another instance, 1 inch of rain to the acre was 100 tons, or, to be more accurate, 101 tons. In the United States, where, as here, they had the option to use legally the metric system, they had not used it. Mr. Sellers, one of the best authorities, had said that the thing was not fit to be used. He would refer the members to one who was not a bad engineering authority, Rankin. He would read to them the last verse of Rankin's song in praise of the three-foot rule:—

“Here's a health to every learned man that goes by common sense;

And would not plague the workman on any vain pretence:

But as for those philanthropists who'd send us back to school,
Oh, bless their eyes, if ever they tries to put down the three-foot rule.”

That seems to me to sufficiently illustrate the standpoint of perhaps one of the best authorities in England, and a very able engineer who knew something of what he was talking about.

Another gentleman, Mr. H. Bauerman expresses the opinion, “As the result of long experience in the use of various metrological systems in different countries, he was unable to agree with the Author's conclusions as to the desirability of internationalizing the metrical system to the exclusion of all others. He thought that the weights and measures used at any particular time by any people fairly correspond to their local and temporary necessities and as new necessities arose, they would be met by the adoption of new, or by the modification of old, units.”

I will wind up by a remark from Mr. Ferdinand Hurter, who says, “That the only important reason for a change from the English to the metric system was that many nations had adopted the latter;” and he compares the yard in this way: “It was in the workshop that the English system was superior to the

French; and the English inch was the standard for screw-cutting, not only in England, but throughout the world. It must not be forgotten that the British public was not prepared, nor preparing for such a change. Decimal calculation was unknown to the mass of the people. Boys were allowed to leave school, having passed the fifth standard, void of all knowledge of decimal arithmetic. Surely it would be unfair to take the masses by surprise. But if the metric system must be, let it be the metric system pure, the metric system compulsory; not a metric system at the option of any engineer. Let there be no mixture, particularly in plans to be submitted to, and discussed by, parliamentary committees." (Applause).

SURVEYORS AS REFEREES.

Mr. McDowall:—Mr. President and Gentlemen, I was made referee, by appointment from Judge Masson, in a dispute over a line in the Township of Howick, in the County of Huron. When the appointment reached me I looked up the Act regarding the matter. The first thing in the Act I noticed is that arbitrators are supposed to take an oath before starting, but there is nothing mentioned in the Act about referees taking an oath. I made enquiries of a solicitor, and he thought I had better take the oath. I took it, and sent it on to the Judge, and I sent certified Field Notes of the line in dispute. I came to Toronto and looked over the rest of the Township in close proximity, for fear the notice I received would not cover the country when I arrived on the spot. When I arrived there I found it was a very easy survey indeed; the original stakes were found and proven without much difficulty. The line had been run by two Provincial Land Surveyors, Mr. Bolton, of Listowel, and Mr. J. McNab. There was a difference of some sixteen feet between us at the back. The depth of the lots in question was fifty chains. The bearing line was the County line between Bruce and Huron; and it was between lots one and two, just eighty rods in width. On the front of the lots we almost all agreed within a few inches. At the back I was further south than either Surveyor; I was eight feet from Mr. Bolton and twenty-four feet from Mr. McNab.

The defendant in the case lost. I sent in my bill, estimating my time at \$20 a day. They brought my bill before Mr. Thom, the Taxing Officer at Osgoode Hall, to have it taxed; and I attended on the taxation. Mr. Thom cut my bill down some; he gave as his reason for that that I was there as a Surveyor merely, unless I heard evidence on the ground; that I was only the arbitrator in the case of hearing the evidence; and he would only allow me \$20 or at the rate of \$3 an hour for the time I spent in taking the evidence on the ground. \$3 an hour is what the Act calls for. For the balance of the time he gave me \$6 a day and my expenses.

Mr. Kirkpatrick:—I did a little better than that. I was appointed Referee by the High Court of Justice in a case of a disputed survey in the Township of Saltfleet, in 1899, under the

same Act. I went on the ground and I took evidence as an Ontario Land Surveyor in the case. I traced up all I could. I took a good deal of the time in doing it because it was very difficult to find anybody who knew anything at all about the original survey, it having been made in 1797. I then examined into the special section of the Act which related to it, and I searched back to find the preamble of the original Bill. I found there the explanation which of course has not been reproduced in the Act giving the reasons why the Act was changed in that particular case, and fully explaining the whole system of survey and how it should be run. I have since found that there is in Mr. Esten's "Disputed Cases," published by this Association, a decision which was made by the Court prior to the date of the introduction of the alteration of the Act; that bore out my survey in accordance with the Act; and if I had only known of it before, it would have saved me much time and trouble. That case had evidently escaped the notice of the Judge, and of the solicitors on both sides and of the Surveyors on both sides as well, because had they had it they could have at once seen the proper mode of procedure in running that line; because the Court had decided prior to the amendment of the Act that such was the proper way to run it. I fancy after that that it was thought better to introduce an amendment which would set out in definite words what the Surveyor should do. That is, in those townships in which the side lines have been run and the concession lines have not been run, that a side line should be traced out on the ground in the same way in which it was originally run in the first survey. In the Township of Saltfleet, I found, by looking over the notes of Augustus Jones, that he ran one side line from the south to the north, and then crossed over and ran the next side line from the north to the south, and so on through the Township. When a Surveyor is called on to run a side line in any Township he has to use the side line in exactly the same way as if it were a concession line, that is, he must find a point, or two points, on the side line through the township and join those to his original work on the ground. That I did, and sent my report to Chief Justice Armour. I sent my bill in charging \$20 a day and travelling expenses; and it was paid without a murmur.

President Ross:—The difference between you and Mr. McDowall apparently is your account was not appealed against.

We are very glad to hear the experience of these two members

of our Association, and it will probably prove valuable to other members.

Mr. McDowall:—Where should these reports be filed ?

The Act calls for plans to be filed in the Registry Office. I sent my whole report to the Judge.

Mr. Van Nostrand:—I think, as far as I can learn, the proper place for filing those papers is with the Registrar of the Court in the County in which the action is begun. I had a case last spring—it was not the same kind of case as we have just heard of—under Section 2 of the Act which provides that the parties before the action comes to trial may agree to refer it to a Surveyor, and in that case the Surveyor is practically the Judge; and the plaintiff and defendant, each by his solicitor, have to be heard by the Surveyor as Referee, just in the same way that an ordinary reference is made at Osgoode Hall. In this case there were three parties to the suit, and necessarily three lawyers and they all insisted on all the legal machinery being proceeded with. The witnesses were called and examined by the solicitor calling them, and cross-examined by the other solicitors; and all the evidence was taken in writing and signed by the witnesses after it had been read over to them. Affidavits, such as are usually taken under Chapter 181, would not do there; it had to be oral evidence. The report of the Referee was to be filed with the Registrar of the Court, and it was so filed, and the Registrar forwarded it to the Judge, and the Judge made his finding on that report. I was so fortunate in this case as to have the Judge agree with me; and if our stenographer will only close his ears for a moment I will confess I charged only \$15 a day. My bill went through all right and I did not have to attend any taxation. I think in the end that I came out just as well at \$15 a day as if I had made it \$20 a day and charged for fewer days. I do not, however, desire this to be considered as a precedent for other references.

President Ross:—Did they allow you a stenographer to take the evidence ?

Mr. Van Nostrand:—The solicitors agreed amongst themselves that one of them who was not, as it happened, actively interested in the case should take down the evidence in long-hand. He was familiar with that class of work, and he took the evidence down in extenso while it was being given; and it was all signed while the witnesses were yet there. In other

cases it might be that a stenographer would be necessary, and in that case, of course, he would have to be a Court Stenographer or other properly qualified stenographer. The fact that an unofficial stenographer might be able to do the work would perhaps not be sufficient.

I think it a good thing that this matter has been brought before the Association, because it is an Act that has not been made very much use of as yet; it is comparatively new; and cases may crop up at any time. It seems to me that the Act provides the common-sense way of settling these disputes, because they come before the men who are best qualified to decide on the points; and as a rule the courts will hold with what the Referees decide. The expense is considerably lessened in these cases, because the evidence is taken right on the ground instead of going to the expense of bringing all the witnesses to the legal centre. In the case I had, I know a great deal of expense and a great deal of time were saved and I think the results were probably better than they would have been if taken up before the Judge, and Surveyors only called in as witnesses. The fact that the Act provides that the Referee's charge shall not be less than \$10 or more than \$20 a day is also rather in favor of the ordinary practitioner.

On the question of the per diem charge, I have made some enquiries and I find that in cases of arbitrations and references to judges and legal practitioners, it is customary to have a consent given, signed by the solicitors for both parties, something to this effect, "It is consented by counsel for both parties that the total number of hours occupied by the Referee in hearing evidence or argument and in considering his award or otherwise in connection with this reference shall be added together and such total number shall be divided by six, and that each six hours of the said total number shall be taxable as a statutory day. Fractional parts of days shall be taxable at the same rate. Adjournments are to be taxable as provided by the Statute.

This prevents any possible chance of an appeal to taxation on the question of the Referee's right to make the per diem charge of \$20 per day as provided by the Act.

President Ross:—In what year was the Act passed?

Mr. Van Nostrand:—It is in the Revised Statutes of Ontario, 1897; and it is published in our Manual at page 37. It is very interesting reading.

Mr. Walker:—Did I understand Mr. Van Nostrand to say that he did not take any measurement on the ground; that he was the Judge altogether.

Mr. Van Nostrand:—I took the evidence on the ground. And I had learned that the former survey had been made many years ago by Mr. Passmore; and knowing that his Field Notes had not been filed, that it was simply a survey ratified by Act of Parliament whereby only the work on the ground and the plan as recorded in the Crown Land's Department were official, it was necessary to have the consent of the parties to consult his Field Notes. These Field Notes I found, after a great deal of trouble, and they practically settled the point. They were very definite as to what was done in that particular case, and they showed clearly how their survey should be made. Without those Field Notes the results might have been very different; but the Field Notes were very satisfactory. Knowing that Field Notes are not considered official, nor considered evidence unless the Surveyor is there to swear to them, I overcame the difficulty by getting the written consent of each of the solicitors acting for the three parties and that estopped them when they came to the Judge. Copies of the Field Notes relating to the question were filed, that was included in their "Consent." Exhibits were put in, I think about a dozen or more; they all had to be put in; and everything was done in the usual court form. This, however, was quite a different style of reference from those referred to by Mr. Kirkpatrick and Mr. McDowall who were called in really to assist the Judge after he had the witnesses before him. In the case I had, the parties agree on a joint Surveyor or Referee and the Judge simply found on the Referee's finding.

Mr. Walker:—The point I wanted to get at was, did you make any surveys at all?

Mr. Van Nostrand:—The surveys were made after the Notes had been consulted, but that was a comparatively unimportant matter; it was simply ranging a line between two points on either side of the concession.

Mr. Walker:—The evidence you took was more to decide on the governing points.

Mr. Van Nostrand:—The evidence was to fix the governing points, and to decide as to whether there was originally a jog at the blind line. The survey was a small matter and (including the planting of six monuments) was done in one \$15 day.

President Ross:—You get the Referee's fee for your survey as well as for acting as Judge.

Mr. Van Nostrand:—Yes, throughout.

Mr. McDowall:—I might say that, in my case, I was advised by Mr. Thom to always make my bargain before I started on my reference.

TRACK SURVEYING.

Mr. Stewart:—I can give an account of a little track surveying, (if by that term is understood an approximate survey of a route), that I undertook a few years ago. I was going to spend my vacation in the Rocky Mountains; and we intended to start from a point of the C.P.R. just in the eastern outskirts of the Rockies, and, following the trend of the mountains, keep among them or in their outskirts, nearly up to the source of the Athabasca River. It struck me, before leaving, that it would be rather interesting, as most of the country was almost unknown, if I could bring home some results that would enable me to make a map of our route. I looked through all the different works on surveying that came within my reach but I could find no information as to how such surveys were generally carried out; so I decided to make a traverse of the route, using a prismatic compass to give the direction and a pedometer to give the distance. I knew of course that the pedometer worn in the pocket and carried as one walked along, going up and down the hills and over swamps and wading streams and so on, would give an indication of distance that would very far exceed the straight line distance between any two points; so I assumed that the distance given by the pedometer between two points bore a constant ratio to the straight line distance; and on that assumption I made my survey. Then, wherever possible, once or twice a week, I observed for latitude; I had with me a good marine sextant, reading to ten seconds, and an artificial horizon. I observed also for time, although the watch I had with me was not a very reliable one, but I wanted to compare the determination of longitude given by the watch with the determination by dead reckoning afterwards. On my return I set to work to make a map from my notes and observations. I fixed the geographical position of the starting point from one of the Geological Survey maps—it was a point near the C.P.R., which was pretty well determined, so I had no difficulty in fixing its position geographically, fairly closely. I then drew on a scale of five miles to the inch, the meridians and parallels of latitude within the region which we had explored. Then, with reference to these meridians and parallels I located the position of the starting point. From thence I plotted my traverse, correcting my compass readings for variation; and reducing my pedometer distance from point to

point by about a third, so as to approximate to the straight line distance between points at which bearings were taken. I plotted the traverse then from the starting point to where my first latitude observation was taken. I found the position of this point with reference to the nearest parallel to be a little too far north, on comparing it with the observation for latitude. Then assuming that the pedometer distance between two points bore a constant ratio to the straight line distance, the direction of a line joining the terminal points of an extended traverse would be correct; so I joined the point determined by dead reckoning at where the first latitude observation was taken with the starting point, and then at the point in which that line intersected the parallel drawn through the latitude observed. I located the point; and then I squeezed the whole traverse in and made it fit between those two points. The plotting of the traverse line on the map was carried on in the same way to where the next latitude observation was taken, and that point was located, in the same way, as just described. In this way I plotted the whole route.

I afterwards plotted the topography, sketched in the mountain ranges and streams, and so on, with reference to the traverse line. I have reason to believe the work was fairly correct. Our route lay in a north-westerly direction, so that it was the best direction for surveying in that way. I was able to compare the position of a certain sketch of the Athabaska River; determined from my survey, with its position as determined by Captain Pulliser about thirty years previously. He explored from another direction; he went from Edmonton, and crossed the Athabaska, working up to the Jasper House, and carrying on his explorations from there to near where we left off. He spent several months, I believe, at the Jasper House, and made a number of determinations by lunar distances of the longitude of that place. From the Jasper House, in going up-stream along the Athabaska, you are going nearly south, so that the longitude of the point where we ended our explorations is about the same as that of the Jasper House; and comparing the position of this stretch of the Athabaska River with its position as given by Pulliser, they agree within a fraction of a mile; and as my determination was made altogether by dead reckoning, merely correcting a traverse line by latitude observations, it is a very good check on the accuracy of the whole survey. I think this is the best method to follow in making a track survey. The great difficulty of course in mak-

ing such a survey is to get a reliable determination of distance; but if some method is used that will give a determination of distance that will bear something like a constant ratio to the true distance I think you can, by correcting your work by frequent latitude observations, make a survey of a considerable portion of country from which a good map can be constructed. The map that I made from about two months' work covered a piece of country about 300 miles long by 50 or 75 wide; the survey was made single-handed and I think was fairly accurate.

Mr. Tyrrell:—What method did you adopt in determining the variation?

Mr. Stewart:—The method I frequently adopted was, after observing for time, to take a number of compass bearings of the limb of the sun, noting the time, and then afterwards comparing the true bearing of the sun's limb from its declination at the time, its hour angle, and the known latitude. Having found the true bearing in that way, a comparison of the compass-bearing gave the variation.

Mr. McDowall:—Suppose the country in one place was very level would it bear the same reduction of distance?

Mr. Stewart:—It would not, strictly speaking; but in the long run errors would tend to compensate one another.

Mr. H. H. Gibson:—How closely can you determine latitude with a sextant?

Mr. Stewart:—Comparing my different latitude determinations, I think with a marine sextant like mine, with an artificial horizon, you can get latitude within ten seconds, by making a number of determinations by circum-meridian altitudes, and taking the mean, assuming there is no eccentric error in your sextant. There might be a large eccentric error which should be determined.

President Ross:—You said you did the work single-handed. I suppose you had assistance to carry your outfit. I presume you speak of the instrumental work when you say that.

Mr. Stewart:—Yes. Our party consisted of three besides myself, and then we had a couple of Indian guides and packers. I meant as far as the instrumental part of the work was concerned.



PAPERS.

[This Association is not responsible as a body for the opinions expressed in its Papers by Authors.]

LOCAL DEFLECTION OF THE PLUMB LINE.

BY OTTO J. KLOTZ.

In the present short paper it is only intended to lay before the Society certain data of the deflection of the plumb line as found by latitude observations and azimuth surveys along the International Boundary, 49th parallel, from the Lake of the Woods to the Pacific Ocean. Those westward, as far as the Rocky Mountains, were published years ago in the United States Report of the Northern Boundary Survey, but those of British Columbia have, to my knowledge, never been published. The effect of deflection of the plumb line on longitude and azimuth observations is not considered in the present paper.

Deflection of the plumb line may be defined as the deviation of the vertical at any point from the normal at that point to the surface of an assumed figure of the earth. In dealing with the earth, we must assume its shape to be of some definite geometrical form and of certain dimensions, for only then can observations, at different points thereon, be correlated and adjusted. The best assumed form (Clarke's 1880 spheroid at present), however, differs at places widely from the actual form or geoid. To illustrate, if the continents were traversed by narrow canals, communicating with the ocean, their surface, although level, would be wavy or undulating, and would be in some places above, in other places below the surface of the spheroid or ellipsoid of revolution, the divergence of the two surfaces being probably confined to a few hundred feet.

The position assumed by the plumb line, is due to the law of gravitation, that is, it is the integrated result of the attraction of the individual particles, composing the mass of the earth, and hence the position is affected by the relative distribution of them. We may, therefore, say that the unsymmetrical distribution of the particles, whether on the surface, as mountains, etc., or in

the thin crust, is the cause of the deflection of the plumb line from its theoretical position. The ablest mathematicians have been engaged, ever since the era of precise measurement, upon this difficult question of the form and dimensions of the sea level surface.

In some instances we are quite prepared to find local deflections of the plumb line, for example, when observations are taken on the plains at a point near a more or less isolated upheaval, as the Three Buttes or Sweet Grass Hills in Montana, just south of the International Boundary. These hills, as we shall see later, pulled the 49th parallel out of its theoretical position about 800 feet. On the other hand, large deflections show themselves without any visible reason or cause as evolves from numerous observations and their geodetic connection. A remarkable instance is that of the comparatively plain area surrounding Moscow, which I visited recently, where, on the margins of an eighteen mile east and west zone, large deflections of opposite signs were found. From this it must be concluded that there exists beneath the surface a cavity or at least matter of small density.

It is evident, therefore, that the observations alone, at any particular point, are not conclusive for fixing its geographical position upon the surface of the earth, but that numerous astronomically determined points must be connected linearly by triangulation, and from their inter-accordance, or discordance, the most probable values determined, based upon an assumed figure of the earth.

In our own city here (Ottawa), there appears, due to the topographical configuration, to be a deflection of the plumb line; for, the latitude determinations made by me at the observatory on the summit of the escarpment, compared with those made some years ago by Mr. Lindsay Russell on the opposite side of the river, show a discrepancy of about a second of arc, equal to about a hundred feet, a quantity greater than the error of observation. However, a more or less extended hypsometric survey would be necessary for a plausible *a priori* conclusion with reference to the probable discordance in latitude to be expected between two stations.

All observations for the determinations of positions upon the earth depend upon the direction of the vertical. Latitude and longitude observations, the surveyors' and engineers' operations, all have their zero of reckoning in the centre of the level bubble,

and any displacement of the latter, which is equivalent to the displacement of the plumb line, affects the results, and will show discordances when widely separated observations are geodetically connected.

It may be stated that a delicate level used for latitude work, reading to a second of arc, has usually a radius of about 1,700 feet, or nearly a third of a mile, for the curve ground on its inner upper surface.

To digress for a moment.

Boundary lines may be divided into three classes: those representing a social unity, those representing a physical unity, and those representing a political unity. Those of the first find the largest number of representatives in the older settled countries, for the primal concept of boundary was to conserve the social unity. It was not to define territorial extent as much as to define or assert the domain of a like people; like by language, race, or religion or other affiliation. Such boundaries are, as a rule, very irregular and difficult to describe. When the social organism reached that development that written treaties became necessary between adjoining peoples, the description of the separating boundary was made from the boundary *de facto*, and the boundary not laid down from the description.

The second class we may consider an expansion of the first, resulting from conquest, whereby a physical as well as a social unity was to be preserved. Of the physical boundaries—mountains, rivers and lakes—to serve the purpose of barriers, by mountains, that end is undoubtedly best attained. Europe furnishes a number of examples of this.

The third class, which we may call the astronomic boundary, is a development of recent times, and applies invariably to areas practically unsettled, unsurveyed and little known. Such can be laid down on paper, or described in treaties without scarcely any knowledge of the country whatsoever.

While Europe furnishes the most examples of the first, America does so of the last. Many of the State boundaries of the United States are astronomic lines, either meridians, parallels, or lines of definite azimuth. Similarly with the subdivision of Australia and recent boundaries in Africa. Astronomic boundaries may generally be taken as an index of the ignorance existing of the country or area involved and its resources.

Boundaries under the first division are difficult for definition or restoration when such is necessary. Those of the second,

always dependent upon water, are generally self-evident, while those of the third are comparatively easy of determination.

There are instances of a fourth class of boundaries—where the position of it is dependent upon the position of a physical feature—e.g., that it be at or within a given distance from a river or the sea.

A notable case of the last is that of south-eastern Alaska, as described in Article 4 of the Convention of February 28, 1825. Such boundaries are exceedingly difficult to lay down on the ground, requiring, too beforehand laborious mathematical calculations. The Railway Belt of British Columbia, extending twenty miles on each side of the Canadian Pacific Railway, gave the writer an example of such computation.

A river, and least of all a large river, a commercial artery, forms an undesirable international boundary. The very nature thereof makes it a route of travel, and hence of settlement on its banks, which, if in possession of two countries, is almost sure to lead to trouble. Hence we find few or no large rivers forming such boundaries, although our own St. Lawrence does for a short distance separate us from our southern neighbor. A summit or watershed boundary is pretty satisfactory, if restricted to mountains, but when applied to plains or undulating country, is fraught with difficulties. The difficulty consists in establishing the line of watershed, as was presented in the Maine-New Brunswick controversy early in the century.

Of the several classes of boundaries spoken of, none is as immutable as the astronomic one. Of the first, the original monuments and records may disappear, and personal evidence be wanting. Of the second or physical boundary, time may bring about changes quite as marked and cause the line to move therewith. As a well-known instance, the Mississippi may be cited. In a recent report of the "Idaho and Montana Boundary Line" we have another illustration. It is stated that "from a geological standpoint, but hardly from a practical one, however, there is another reason why monuments should not be placed on the summit of the Bitter Root range, as marking the boundary line between Idaho and Montana. There is abundant evidence that the summit is what is known as a retreating or migrating divide: in other words, the waters tributary to the Bitter Root River in Montana are continually capturing by erosion those of the Clearwater River in Idaho, so that the divide is slowly being shifted to the westward, thus adding to the territory of Montana

and diminishing that of Idaho. The existing divide is uniformly from six to eight miles from the irregular line representing the original divide, if the latter may be accepted as having passed through the highest points of the range, which seems probable."

When a boundary is defined by a parallel of latitude, the question invariably arises, in the demarcation of it, whether the astronomic or mean parallel is to be adopted. The astronomic parallel is that line on the surface of the earth on which direct observations for latitude give the same elevation of the pole; geometrically, for the spheroid or ellipsoid of revolution, it is the intersection of the cone, having its apex in the minor axis of the earth and making an angle therewith equal to the complement of the latitude, with the surface of the earth. Principally owing to the local deflection of the plumb line, points astronomically determined in latitude will not "close," that is, the line projected or run from one station as a parallel will not meet the next point or astronomic station.

That line with reference to which the sum of the discrepancies north is equal to the sum of those south is the mean parallel.

However, as the latter can only be determined *after* the location and connection of the astronomic points, entailing revision of the whole work, and besides the difficulty of re-establishing points on the mean parallel in case of loss or disappearance of monuments and marks, it has generally been decided to adhere to the simpler and more readily established astronomic parallel. All such parallels traced upon the earth are irregular curves.

The International Boundary Line, between the Lake of the Woods and the Rocky (Stony) Mountains is defined in the second article of the Convention of 1818 as being the parallel of 49 degrees north latitude. The immediate cause of the delimitation of the boundary was the discovery that the fort of the Hudson's Bay Company at Pembina was nearly a mile within United States territory.

The field work was begun in September, 1872, and finished in the same month two years later, while the proceedings of the joint commission were brought to a conclusion May 29, 1876.

On this line of 860 miles, 40 astronomic stations were established, and 388 monuments erected.

After due consideration, the commissioners agreed upon the astronomic parallel. The recommendation for this, by the chief

astronomers of the commission, was based on the following grounds: "1st That the portion of the parallel of 49° included within the operations of the commission, being only about one-twentieth of the entire circle of latitude, was not sufficient to fix, with any mathematical accuracy, the true position of the mean line of 49° , and that, therefore, if such a parallel were described, depending on the mean of the astronomic stations, no known point of the boundary would be in latitude 49° ; 2nd That as the amplitude of the arcs, included between the mean and the astronomical parallels, would in many cases be very considerable, grave errors and complications might arise in the subsequent re-survey of any lost portion of the boundary; 3rd That the definition of a mean line would involve a re-adjustment of the whole boundary, after the first careful survey should have been completed, and consequently a very considerable increase of expense without any practical benefit accruing; 4th That for every purpose except that of geodetic computation, a parallel of points determined astronomically (instrumental errors aside), is a true parallel of latitude, and therefore, fulfils the stipulations of the treaty under which the joint commission was organized."

Accordingly, astronomic positions were determined at approximate intervals of twenty miles. These stations were connected by tracing upon the ground tangents to the prime vertical circles at each successive point. From these tangents, checked and corrected for errors of azimuth, the calculated offsets to the small circle of latitude were measured at convenient intervals, varying from one to three miles. From the last mentioned offset the relative station error (deflection of plumb line) was found and distributed between the two stations in the ratio of the distances where offsets were taken. From this method it results that the boundary line, as actually traced, is an irregular curve, affected at each astronomical point by instrumental errors and by the local deflection of the plumb line, making the closest probable approximation, at every point, to a true astronomical parallel.

Of the forty astronomical stations on the 49th parallel, four were observed jointly, seventeen by the United States astronomer and nineteen by the British. The mean of the probable errors of the British stations was $+".088$ and of the United States $\pm".059$. The average of the probable errors is then a little over seven feet.

The greatest difference of station errors is $13".89$ or 1.407 feet, being in a distance of $97\frac{7}{10}$ miles, between the Cypress

Hills to the north of the boundary, and the Three Buttes or Sweet Grass Hills near, and to the south of the 49th parallel. The station error of the former is + 5."94, of the latter — 7."95, that is, the Three Buttes pulled the 49th parallel 805 feet south, and the Cypress Hills 602 feet north of the mean parallel. The greatest discrepancy between adjacent stations, about twenty miles apart, is 7."28 or 738 feet, near the Three Buttes. From Lake of the Woods, westward, into the valley of the Red River, the station errors increase, and for a reason, which from our lack of knowledge of the underlying strata, must be conjectural. The escarpment of the Pembina Mountains (elevation would be a more appropriate term, height 1,695 feet), naturally draws the vertical southward, continuing to do so until the Turtle Mountains (of moderate elevation, 2,550 feet) are reached, which, too, deflect to the south. After entering the Coteau of the Missouri we pass along the southern base of the high ridge separating the waters flowing into the Gulf of Mexico, from those flowing into Hudson's Bay, and find, naturally, a deflection to the north, increasing to a maximum, south of the Cypress Hills (3,800 feet). Here the enormous intrusive masses of the Three Buttes, produce a violent disturbing effect, drawing the astronomical parallel to the south, at an average rate of 14 feet to a mile, for a distance of about one hundred miles. When we actually enter the tumultuous Rocky Mountains, with all their varied conditions of compositions, of faults and dykes, and our lack of hypsometric maps, we are unable to even make a plausible estimate in which direction the local deflection is to be expected. Even the relative deflection between adjacent stations remains unknown in most cases on account of the great difficulty in connecting them geodetically.

As a very remarkable example of the deflection of the plumb line may be mentioned, the one on the arc of the meridian between Andrate and Mondivi, in northern Italy, where in a distance of a little over seventy-seven miles, a difference of nearly forty-one seconds was found, that is to say, the difference in the distance between these two terminal points determined by direct astronomic observation, and also linearly by triangulation was found to be about 4-10 of a mile. How much of this quantity is attributable to each place for local deflection, and again, how much is due to relief or topography, and how much to the unequal distribution of masses beneath the surface of the earth, is not known.

It is evident that observations at two places which are also geodetically connected, can only give the relative deflection of the plumb line.

For the boundary between the Lake of the Woods to the summit of the Rocky Mountains, the Commissioners agreed that the line joining any two adjacent monuments shall be an arc of the parallel. This was to apply, too, in the case of restoring any monument whose position was lost. This agreement differs from that of the boundary commissioners, who had charge, some seventeen years previously, of defining the boundary from the Gulf of Georgia to the summit of the Rocky Mountains. They agreed that the connecting line between monuments shall be a straight or direct line, i.e., an arc of a great circle.

The international boundary commission appointed to define the boundary under the first article of the Treaty of June 15, 1846 (the present southern boundary of British Columbia), was organized in 1858 (first meeting August 13th), and in the summer of the same year began field work at the western terminus of the boundary. The observations and surveys were carried eastward under great difficulties, owing to the heavy forest and mountainous character of much of the country. Early in 1862 the field work was completed and the preparation of the maps begun, which were, however, not completed and jointly signed by the commissioners till 7th May, 1869. A report was never published.

Between the extreme east and west points, upon the watershed of the Rocky Mountains, and the eastern shore of the channel which separates the continent of North America from Vancouver Island in west longitude $114^{\circ} 03' 34''$ and $123^{\circ} 3' 53''$ respectively, the exact length of the boundary line upon the 49th parallel of north latitude is 409 4-10 miles. The position of the parallel was determined by 28 astronomical stations, 11 of which were established by the British Commission, 14 by the American Commission, and 3 were observed by both. Another station was fixed by the British Commission at Schweltza Lake, but it was at the time rejected on account of the apparently large deflection of the plumb line, though the after experience of the most accurate instrumental observations in that mountainous country, led to the conclusion that the result at Schweltza was quite as trustworthy as any of the others. It is, however, not included in the final determinations.

At the first meeting of the Commissioners at Semiahmoo, August 13, 1858, it was concluded, after discussing plans for determining and marking the line as far as the Cascade Mountains, to be inexpedient at that time, in consequence of the great expense, consumption of time, and the impracticable nature of the country, to mark the whole boundary by cutting a track through the dense forest. It was therefore agreed to ascertain points on the line by the determination of astronomical points at convenient intervals on or near the boundary; and to mark such astronomical stations or points fixed on the parallel forming the boundary, by cutting a track of not less than 20 feet in width on each side for a distance of half a mile or more, according to circumstance. Further, that the boundary be determined and similarly marked where it crosses streams of any size, permanent trails, or any striking natural features of the country. In the vicinity of settlements, the line to be cut a greater distance. Bessel's value of the figure of the earth was adopted.

From the two points on the parallel, dependent respectively, on the Sumass and Schweltza astronomical stations, cuttings were made to connect the points. When the cuttings met, there was found to be a discrepancy of 8", say about 810 feet; they were, however, connected, though the line thus defined is obviously not strictly *the* boundary of the treaty. The distance is about $9\frac{1}{4}$ miles. This relative deflection of the plumb line, 8", in so short a distance, is the largest on the whole 49th parallel, from the Lake of the Woods to the Pacific. When the cuttings on the parallel from Sumass and the British station at Semiahmoo met, there was a discrepancy of 114 feet in the 20 miles, and between the United States astronomical station at the east shore of Semiahmoo Bay, and the British one five miles east thereof, a discrepancy on the parallel of nearly nine feet was found, an error quite within the error of observation.

The only other cutting on the whole boundary line west of the Rocky Mountains, connecting adjacent astronomic stations is between the Similkameen and the Columbia rivers, a distance of 96 miles. The stations there in order eastward are: Similkameen (U.S.); Lake Osoyoos (Br.); 1st Crossing Newhoilapitkw (U.S.); 2nd Crossing Inshwointum (Br.); 3rd Crossing Statapoosten (U.S.); and on the Columbia (Br. and U.S.). From the point on the parallel at Lake Osoyoos, a line was run east and west $30\frac{1}{2}$ miles, connecting with similar points at Similkameen and at the 1st Crossing. The line was found to

strike 509 feet north of the former point and north of the latter 364 feet, showing a marked deflection of the plumb line. When, similarly, an east and west line was run from a point on the parallel at Inshwointum, it was found to be south 300 feet of the point on the parallel at the 1st crossing, and 180 feet north of the point at Statapoosten.

This shows, therefore, a discrepancy between the latitude of Lake Osoyoos (Br.) and Statapoosten (U.S.) of 844 feet, due to local attraction or difference of local attraction. After verifying the accuracy of the latitude observations, it was decided to adopt the mean parallel, based on the differences found, between Similkameen and Statapoosten—a distance of 71 miles. This is the only part of the whole boundary line between the Lake of the Woods and the gulf of Georgia, where a mean parallel has been adopted for the boundary, instead of the astronomic parallel. These seventy-one miles were re-cut on the mean parallel. From the extremity of the mean parallel at Statapoosten, an east line was run to the Columbia, where a difference of 212 feet was found between the mean of the British and United States latitude determinations there and the mean parallel. The line (for final boundary) was thereupon deflected from Statapoosten so as to strike the above mean Columbia position of the 49th parallel.

The actual definition of the boundary is as follows: Its western extremity is marked by a substantial granite obelisk in longitude $123^{\circ} 03' 53''$, west, standing upon a steep cliff on the western face of the promontory of Point Roberts, about 160 feet above the sea. For 44.8 miles eastward there are 42 iron pillars placed at suitable points on the boundary. One pillar stands on the eastern face of Point Roberts, 2 miles 704 yards from the obelisk, and there are two intermediate pillars in the interval at average distances apart of somewhat more than $\frac{3}{4}$ mile. A pillar on the west shore of Semiahmoo Bay is 12 miles 1,777 yards from that on Point Roberts on the opposite side of the bay; and thence is $29\frac{1}{4}$ miles to the easternmost pillar, the average distance apart is about 1,380 yards, varying between 1 mile 1,245 yards and 198 yards on the opposite bank of the Sumass River. These pillars all stand in a continuous cutting through the forest or in intervening patches of swamp and prairie. From the easternmost iron pillar, to the right or west bank of the Similkameen river is 107.9 miles, the boundary is defined in the vicinity of 9 astronomical stations by 19 cairns

or pyramids built of dry stones, and one bench mark cut on the face of a rock at Ensakwatch; and at several stations short vistas were also cut in the forest, between the cairns. This wide interval comprises the rugged and inhospitable region of the Cascade Mountains. One of the widest unmarked intervals on the boundary occurs in these mountains, between Pasayten and Naisnulch, the distance between the marked points being 23.7 miles. From a cairn at the foot of the mountains on the west side of the Similkameen river to the east or left bank of the Columbia, the boundary for 95 miles is well and continuously marked by 69 stone cairns and one mound of earth, and by forest cutting in all necessary cases. This was the most favorable portion of the work, part of the line passing over rolling prairie country interspersed with wood; but very considerable portions were also mountainous, rugged and heavily timbered, though more accessible from the valley of the Newhoialpitkw (Kettle) river than were the Cascade Mountains. Two cairns stand within 129 yards of each other on the east bank of the Columbia (one having been placed by each Commission) and the average distance apart of the remainder is 1 mile 679 yards. From the hill tops the line of boundary defined by cairns and cuttings can be traced for many miles. For the remaining 161.8 miles between the eastern cairn on the left bank of the Columbia river and the terminal point on the watershed of the Rocky Mountains in west longitude $114^{\circ} 03' 28''$, the boundary passes over successive mountain ranges intersected only by the valley of the Kootenay River at two points 75 $\frac{3}{4}$ miles apart and by the adjacent valleys of the Flathead river and its tributary Kishenehu creek. This portion of the line is marked in the vicinity of 9 astronomical stations, by 26 cairns and one bench mark cut in the face of the rock at the Kootenay Mountain Station, and by a cairn fixed by survey on the trail between Kootenay west and Mooyie station; and the usual forest vistas cut at the usual defined points, besides longer cuttings of seven and ten miles at the eastern crossing of the Kootenay, and between the Flathead and Kishenehu rivers. On the summit of the Rocky Mountains the monument consists of a pyramid of dry stones, situate on a narrow saddle with precipitous sides connecting two lofty mountains, serving to identify the locality between the Columbia and the Rocky Mountains, exclusive of the Mooyie trail cairn, and the intervals between the Kootenay mountain and Kootenay west stations, and Mooyie and Yahk stations, the distance between the conse-

cutively marked points at the several astronomical stations averages about $13\frac{1}{4}$ miles; but between the stations named they extend to 25 and 24 miles owing to the inaccessible nature of the intervening country, which is quite as bad as the Cascade Mountains.

As already stated, the Boundary Commissioners had agreed to understand the boundary laid out by them, to consist of a series of straight lines between the successively marked points, without regard to the distances between those points or the curve of the parallel in the longer intervals. That they did upon the consideration that it was of the greatest importance that nothing should be left for future discussion of settlement, and that the operations should be final and conclusive. It may be stated that opposite the centre of a chord of 25 miles in length, the departure from the 49th parallel would be about 40 yards, and of 12 miles, 9 yards. Both these departures are probably far smaller than the deflection of the plumb line, at the governing astronomical stations.

We have, therefore, in the actual boundary line of British Columbia, a deviation from the 49th parallel, as given in the treaty of 15th June, 1846, in so far, that the straight lines replace the curve of the parallel between all the stations, and furthermore, that between Similkameen and Statapoosten, the mean parallel was adopted instead of the astronomically determined points.

We have followed now the 49th parallel for 1,270 miles, about one-thirteenth of its circumference, and it has disclosed to us some of its vagaries as manifested in the latitude component of the deflection of the plumb line. This boundary line is the longest astronomic one on the earth, the nearest approach to it being the meridian separating West Australia from North and South Australia.

The same law or force which causes the deflection of the plumb line, determines the length of the seconds pendulum, preserves the planets in their orbits, and maintains the stability of the universe—is the law of gravitation. Our earth furnishes us with many interesting problems, and the very discordances observed—apparent though they are—tend to lead us on to unravelling the mysteries and intricacies of nature, and to unfolding the unity and harmony of the cosmos.

DISCUSSION.

Mr. Aylesworth:—Not very long ago some newspapers stated that the boundary between Canada and the United States had to be re-run. Is there any question of that?

Mr. Sankey:—I think if there is anything to be done it will be simply to replace some of the monuments.

Mr. Aylesworth:—Some that have been lost or effaced.

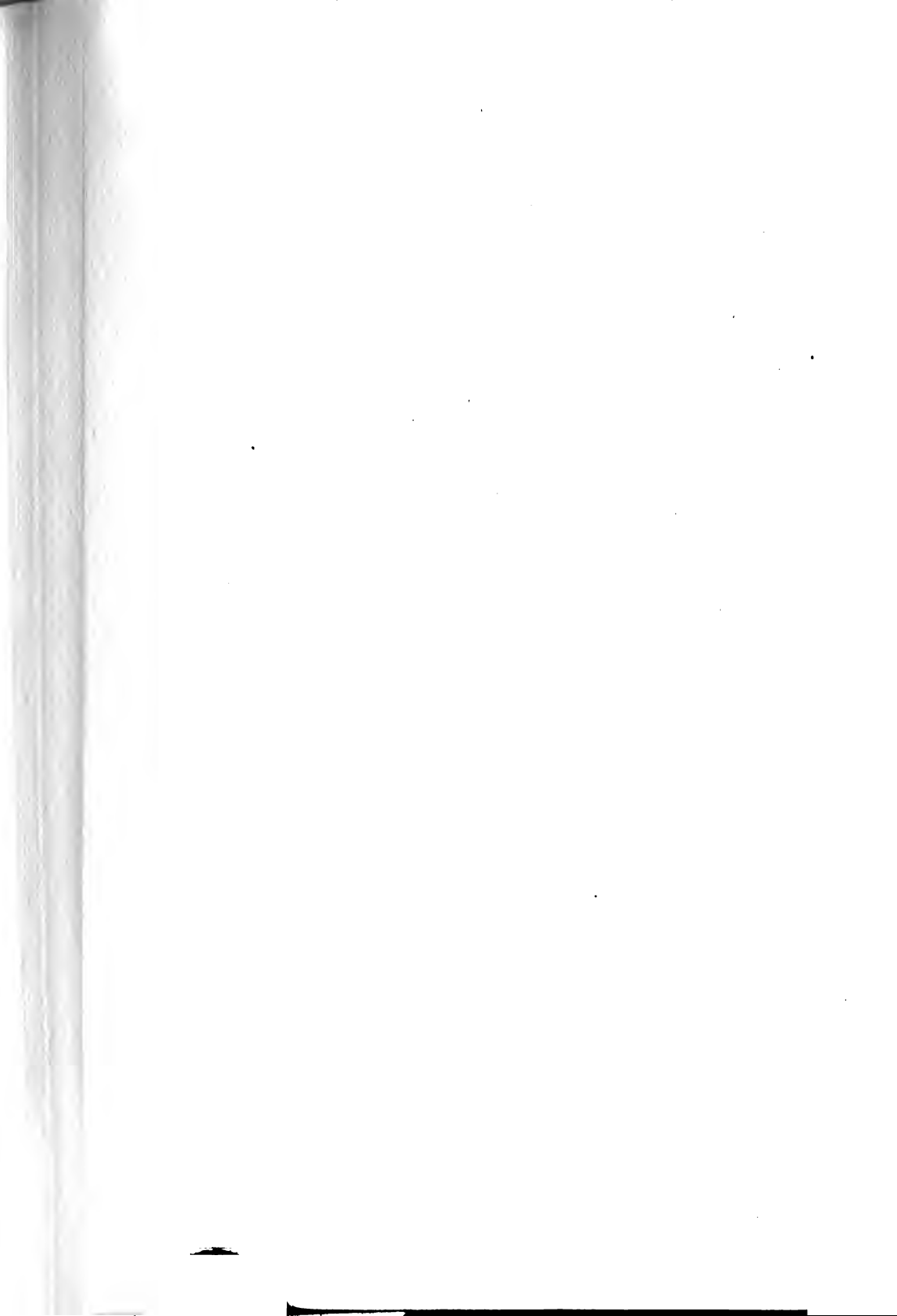
Mr. Whitson:—I think the question arose as to the boundary line between Lake Superior and the West Shore of Lake of the Woods (of which there was not a very accurate survey made), taking in Hunter's Island.

Mr. Sankey:—Doesn't that boundary come under the second clause? Isn't that a physical boundary?

Mr. Whitson:—Yes.

Mr. Aylesworth:—I do not see any object in retracing a physical boundary except in order to lay it down accurately on paper.

The President:—I think Mr. Kirkpatrick gave us an explanation with regard to the Hunter's Island dispute a year or two ago, when it was discussed in the papers. But it would be better just now probably to stick to the points brought up in Mr. Klotz's paper and if any one has any remarks to make or any motion to bring forward we will be glad to have it.



POLAR EXPEDITION.

BY CAPTAIN J. E. BERNIER.

As a Canadian I feel greatly honored in having this opportunity of explaining in the Queen City of Canada my plans for exploring the unknown portions of the Arctic Basin, and reaching the highest latitude possible, sailing through the Strait of Behring, and I hope with the help of God to reach the Geographical Pole.

The desire to draw aside the veil of Arctic and Antarctic is certainly upon us.

Of what use will it be ?

To such a question my reply is:

That both Arctic and Antarctic are of great importance for scientific purposes and commercial in general, if it be merely to contend in what has become an international competition; no country is so ready to appreciate, and reward the explorers of other nations or to show so much sincere generosity as our own; and it will be an evil day for Great Britain and Canada when they cease to take part in what has become a competition between all the foremost nations, and are content to yield their portion in the race for Arctic and Antarctic discovery. Our place has been too long in the front rank for us to back out and allow other flags than the Union Jack to wave in the most prominent position.

With the index pointing towards the Poles, our word should be "Forward" and by our action in following that direction we should show the world at large that we are worthy of being called sons of the foremost nation.

The results of scientific importance to be derived from an examination of the immense unknown area round the North and South Poles are as numerous as the region to be explored is extensive. It may be shown that no such extent of unknown area, in any part of the world, ever failed to yield results of practical, as well as purely scientific value; it is impossible that its examination can fail to add largely to the sum of human knowledge; further it is necessary to bear in mind that the Polar Area is, in many most important respects, of an altogether special character, affording exclusive opportunities for observing the condition of the earth's surface, and the physical phenomena there to be seen, under certain singular circumstances, which are

due to the relation of this area to the position of the axis of revolution of the territorial spheroid, and which have to be considered not only with reference to the present time, but to the earth's past history. It may be, therefore, received as certain that discoveries will be made in all branches of science, the exact nature of which cannot be anticipated.

GEOGRAPHY.

A geographical problem of great importance and interest will be solved by completing the circuit from the Straits of Behring via the Pole to Greenland and Spitzbergen towards the Atlantic.

HYDROGRAPHY.

The necessity of investigating the depth of the Polar Basin current and out-put of the surface water, and the amount of ice and sea temperature at various depths.

GEODESY.

A series of pendulum observations at the highest possible latitude as well as the direction of the force of gravity, and such observations would be especially valuable at 90 degrees north.

METEOROLOGY.

Observations of the temperature and pressure of the atmosphere and of the prevailing winds with reference to currents in very high latitude will form valuable contributions to Meteorological Science.

The climates of Europe and Canada, in no small degree depend on the atmospheric conditions of the Polar Area, in which the development of extremely low temperature necessarily leads to corresponding disturbances, the effects of which are felt far into the temperate zone.

MAGNETISM AND PHYSICS.

The extension of research into the Phenomena of Magnetism and atmospheric electricity in the vicinity of the Pole, where so many of the forces of Nature operate in an extreme degree, either of excess or defect.

THE STUDY OF AURORA BOREALIS.

The Study of Aurora Borealis which is amongst the most striking phenomena visible on our planet, and is almost impossible in low latitudes.

GEOLOGY.

A more complete investigation of the Geology of the Arctic regions is extremely desirable, both for its scientific importance and the value of its practical results. The geographical position of Island seen by Dr. Nansen and the crews of the "Jeannette" should be ascertained and some unknown islands may be found in shallow water near the new Siberian Islands. The distribution of small buoys along the course of the voyage from the Straits of Behring to where we will stop in the ice will record the time it takes to traverse the Polar Basin.

BOTANY.

The vegetations, wood and diatoms found in the Polar Basin will require to be studied.

ZOOLOGY.

The life of animals and different species of fish in the Polar Basin will also be observed.

ETHNOLOGY.

Ethnological observations with regard to unknown lands that may be discovered, the distribution of land and water in the Polar basins and many other scientific researches.

Let me explain my views of the Polar Basin.

First, we must divide the nearly stationary ice from the moving ice. We have to draw a line from Greenland to Point Barrow and as we know that Nature does not run any straight line, we have to put a curve to it, as we know that there is accumulation of ice, that has been seen so often by celebrated mariners.

In 1850-51 Captain Collinson's Ship "Enterprise" passed through the Strait of Behring in search of Sir John Franklin, the ship got into the heavy pack-ice, and the ice was extraordinarily thick and impassible, resembling rolling hills. This, with the experience of other explorers, seals the route towards the Pole passing near the Parry Islands. Another argument that I can bring forward is this:

What has become of the relics of all whalers that have been lost in the neighborhood of Point Barrow? They are in this heavy pack-ice, and are pressed upon the shores of the Parry

Islands, and probably never come out of the Polar Basin, being kept back by Grantland and Greenland.

The reports of Sir George Nares and Commander (now Admiral Markham), have proved the age of the ice and its thickness and motion.

SECONDLY, THE MOVABLE ICE.

This portion was well defined by the drift of the "Jeannette" and the "Fram," during the two years' voyage of the former vessel, and three years of the latter, but what we want now is to connect the two drifts into one. The drift ice to the east of the "Jeannette" track will naturally drift more slowly, and in my opinion would take longer time to get to the Atlantic Ocean.

THIRDLY:

The drift in the Polar Basin by the "Fram" and the "Jeannette" is now better defined, and it indicates that the "Jeannette" drifted on the western edge of the deep Ocean; we must conclude by the height and length of Greenland that the deep tongue of the Ocean in the Polar Basin is as long as the land of Greenland, for the depth of this Ocean corresponds with the height of Greenland, and the sooner a ship can get into deep water, the sooner she will get across the Polar Basin, towards the Atlantic.

FOURTHLY:

THE UNKNOWN ISLANDS.

We may expect to see new islands in the neighborhood of the new Siberian Islands, but no land where the water is deep. Wrangell Island and the new Siberian Islands are parallel with the range of mountains that runs in North America from Alaska towards the westward. Another point which indicates the movement of ice to the westward is open water in summer, west of the land, while to the eastward of land there is ice accumulation which obstructs navigation. To the west of the Alaska Coast, New Siberian Islands, Frank Joseph Land, Spitzbergen, Greenland, Ellesmereland and Banksland, there is open water. The Polar Basin to-day is more navigable than it was 200 years ago. There is quite a change for the better in the temperature; open water has been more and more apparent.

FIFTHLY:

The wind problem will also favor a ship by the Behring

route. We must divide the Polar Basin into two parts. In the eastern part the prevailing winds blow towards the Behring Sea and Strait, while on the western part the wind blows towards the Atlantic. Thus an expedition starting from that route would be favored by the wind and the overflow of the Polar Basin, which is caused by the rivers of Siberia, and the thaws of ice and snow during some months in summer, and the rotation of the earth.

Regarding Diatoms found in Greenland and at the Strait of Behring, Dr. Nansen says:

"It is indeed quite remarkable that the Diatoms found off Behring Strait and on East Greenland should so completely resemble each other; it points to an open connection between the Sea east of Greenland and North of Asia. Through this open connection drift ice is therefore yearly transported across the unknown Polar Sea. On this same drift ice, and by the same route, we will put our expedition, and come on this side of the Atlantic."

But Dr. Nansen never went that way.

The Gulf Stream which enters the Polar Basin by the west side of Spitzbergen is warm salt water, and as soon as it meets the fresh water of the Polar Basin it dives under the fresh water and ice, and goes north until it has lost its vitality. What do you think of a basin filled from so many sources? The water must find its own level somewhere. Well I will tell you the Polar Basin Level is higher than the Pacific Ocean and the Atlantic Ocean; some of its cold water goes towards the Pacific Ocean, but the greatest part towards the Atlantic, finding its way between the Parry Islands, through Robeson Channel, and between Greenland and Spitzbergen, which brings us a quantity of polar ice and icebergs from different sources, and also a fine healthy air that we enjoy in summer, for the Polar Basin and its tributaries are the healthiest part of the world.

If you will permit me I will show you on the screen the state of the ice all round the Polar Basin and Greenland as seen by some of the most celebrated arctic explorers.

In April, 1827, the British Government appointed Capt. W. Edward Parry to carry out an expedition to the North Pole by way of Spitzbergen, it having been reported by whalers that there was a vast opening in the sea to the north-west of Spitzbergen in summer. Capt. W. E. Parry tried to reach the North

Pole by that route; putting his ships in shelter at the Seven Islands, he fitted out two boats 24 feet long, each weighing, with their stores, 3,058 lbs., and manned by 14 men. He proceeded to the north at a good speed, but finding the currents against him and making poor progress, although doing remarkable work, he decided to return after having reached 82.45 north. This is an example of working against nature.

On October 14th, 1871, Capt. Tyson and a party of 19 others were separated from the U.S.S., "Polaris" in about latitude 78. north. Unable to regain their ship the whole party remained on the floe and accomplished one of the most wonderful journeys on record. After a drift of some 1,500 miles in 195 days, they were finally rescued on April 30th, 1872, by the sealing steamer "Tigress" (Capt. Isaac Bartletts of St. Johns), in about latitude 53.35, north.

THE REMARKABLE TRAVELLING OF ICEBERGS.

Here, the lecturer pointing to the diagrams he was exhibiting, said,

This iceberg is about 400 feet high and is now leaving the glacier in Greenland.

This iceberg is about 450 feet high, we can see that by the height of the vessel's masts.

This iceberg near Disco is on his way south, and we can see the field ice at his foot.

This little iceberg is on the Bank of Newfoundland and as the waters of the Gulf Stream are melting it, it will soon disappear out of sight.

In 1875 and 1876, Sir Geo. Nares, Commander of the English Expedition through Smith's Sound and Robeson Channel.

Sailed on the 12th May, 1876. Here we see,

Chart of Davis Strait, and route from England.

Ship "Discovery" leading through the ice in Robeson's Channel.

Ship "Discovery" left at winter quarters in Franklin Bay.

Capt. Stephen of "Discovery" Lieut. (now Admiral) Markham and Dr. Moss.

Ship "Alert" nipped off Cape Beachy by an ice jam.

Ship "Alert" off Cape Union, and during the spring, 1876.

Ship "Alert" in winter quarters.

Push for the Pole with sleighs with the party of 17 men commanded by our friend, Admiral Markham.

The Sea of "Ancient Ice."

Admiral Markham and a few of his men planting the flag in 83.20, north.

Map showing the high point reached by Admiral Markham, and the new coast line discovered.

This constituted one of the best equipped expeditions that was ever planned to reach the North Pole; but it was fighting against nature and when Sir George Nares said to Admiral Markham—"How old is the ice?" he replied—"Well, it may be 50, and it may be 500 years old."

This indicates that it is very ancient and constitutes part of the nearly stationary ice, and the fact of constant pressure upon the Greenland Coast was established for ever.

Here we see,

Lieut. Peary, and Mrs. Peary who followed her husband as far as Franklin Bay.

In 1892, Lieut. Peary's plans for reaching the North Pole by Greenland.

Sledge used by Lieut. Peary while he travelled across Greenland. I see that he utilized Nature as well as other forces, and he says that the coldest place in the Polar Basin is on Greenland at the elevation of 8,000 to 9,000 feet.

Lieut. Peary's new plan for reaching the North Pole. I must give Lieut. Peary the compliment he deserves; he is persevering, courageous, and made of the right stuff for an arctic explorer; but I am sorry he took the wrong way to the North Pole, for he has no help whatever from Nature, and the Esquimaux will never be induced to follow him where there is no animal life,—these children of nature will not venture where they cannot get their living.

This picture shows the state of ice in Mr. Walter Wellman's march to the North Pole off Franz Joseph Land on leaving in 1898.

The Duke of Abruzzi's voyage, reaching 86.33, with sledges and boat, shows that the ice is traversable in certain times during part of the year, also the open water on the west side of Franz Joseph Land, which was also proved by our friend, Mr. Frederick Jackson and Harmsworth's expedition.

While we are in the Arctic regions, let us look a little at this.

Map with regard to wind-drifts and currents.
Antarctic.

I will give you my experience in this part of the world as regards wind and currents. From Cape Horn to Cape of Good Hope, the wind and current prevails from the west, from the Cape of Good Hope and around the southern coast of Australia, the wind and tide prevails from the west, and from the southern coast of Australia to Cape Horn, again the wind and tide prevails again from the west, therefore the wind and tide goes round the outside circle of the Antarctic, so that we in our voyages to these different parts take good care to use favorable wind and current, and we always run our eastern down as far south as possible, so all sailors believe in being helped by nature; one frozen in the pack of ice will drift to the east.

Let me illustrate to you the work of nature outside of the Polar Basin by wind-drift.

This chart shows the wandering of the derelict schooner "Fannie Wolston" in the North Atlantic, from October 15th, 1891, to October 21st, 1894, after having drifted from the prevailing west wind to nearly the Azores, then to the south she came back to the west with the Trade Winds, then to the north of Hatteras, having been sighted five different times by different ships and reported; this constitutes part of the work of Nature which I advocate.

The voyage of the "Jeanette" constitutes my first chain of evidence of the work of Nature in the Polar Basin.

Since 1878 I have been deeply interested in arctic voyages, and I have followed closely this expedition. The "Jeannette," formerly named the "Pandora" left San Francisco after being restrengthened on the 8th of July, 1879, for the North Pole, by the Straits of Behring.

Capt. De Long. I give him credit for the route that we have now before us in which consists the first link of work of Nature. Capt. De Long was a young man of remarkable perseverance, he proved it in a letter that he wrote to Mr. Gordon Bennett, proprietor of "The New York Herald," who sent out the "Jeannette."

He says the current will take us north the same as the whalers, but it will be more difficult to get back. This shows

us great courage on the part of Capt. De Long, to leave for a place from which he could see no way to get back.

The "Jeannette" was beset in the ice of the 7th of September, 1879, and from that date Nature had charge of the "Jeannette" until she was crushed by the ice pressure on the 11th of June, 1881. Chief Engineer Melville's boat, landing on Henrietta Island. Capt. De Long and crew left the ship on the 12th June, with five boats and nine sledges, and after 104 days of hard travelling, two boats succeeded in landing in the River Lena.

When the "Jeannette" sunk, some relics were left on the ice, and strange to say, these relics were found some 2,900 miles away from where the "Jeanette" sunk, at Julian Head, some three years afterwards. These relics must have travelled at the rate of about 2 miles per day and this is in accordance with the last 3 months of the "Jeannette" drift.

If the crew of the "Jeannette" had saved provisions enough and stopped on the ice they would have drifted to Greenland the same as the relics.

SECOND LINK OF DRIFT.

Here we see Dr. Nansen, to whom we owe a deep debt of gratitude, and Capt. Otto Sverdrup, with the "Fram."

A vessel especially built for Arctic exploration, she left Norway June 25, 1893, and entered the "Kara Sea," sailing along the coast of Siberia as far as the New Siberian Islands, and the 21st of Sept. of the same year the "Fram" was made fast in the ice in latitude 78° 30' North. From this time the "Fram" was frozen into the pack ice, and Nature drifted her across the Polar Basin towards Greenland, at about North 36 degrees West, in a little less than three years.

On the 14th March, 1895, Dr. Nansen and Lieutenant Johansen left the "Fram" with twenty-eight dogs and three sledges, to go to the North Pole, some 360 miles distant.

Here Capt. Bernier pointed to the following diagrams and pictures:

This shows us the state of travelling in that part.

Dr. Nansen, furthest north, 86.14.

The temperature monthly.

The mean temperature of the twenty-four hours.

Arriving at Franz Joseph Land in Kayaks.

Meeting of Dr. Nansen, with Mr. Frederick Jackson.

The state of the ice during October, 1893.

This illustrates the work of Nature helped by Science.

The combined experience of others who have ventured in the Polar Regions teaches us precisely what the conditions are that we have to cope with, and how they are to be overcome and I maintain that we now know that the Polar Regions can be surveyed and the Pole reached.

Since the Fram returned, certain weaknesses have been discovered in her forward deck, and in her steam power. I have decided to increase both my steam and sail power. I do not intend to use full steam power until we get into the ice, when I will use the steam to force the way to the North. I intend to increase the resistance of the vessel by adding another row of beams all along the ship. The main beams will be level with the ice, so that the pressure will be carried on the main beams. I will also strengthen the engine room by the addition of some temporary beams, and also by some fixed beams. I will burn four and a half tons of coal, as compared with the Fram's four tons, and with that I will be able to get more power when needed. We have to be very saving of our coal, because four years is a long time. We will have a distiller connected with our cooking stoves, so that we will be able to distil salt water, in order to obtain fresh water, when we have not got snow to melt. And even the snow has a certain amount of salt in it. We will have a good deal of condensed food for our sleigh expeditions. My intention is to endeavor to reach the Pole by sleighs and small boats. The boats will be portable boats, similar to Nansen's, but improved. The sleighs will be built for carrying oil, and will be non-sinkable. Each one will be a combined boat and sleigh, and when there is wind, we will utilize sails on them.

I think I could reach the Pole in one season and come back the next, but I do not approve of the route I should have to take, because no scientific results would follow. I put this statement before the public because it was thought that three or four years' absence was too long. The answer to that is that it could be done in a shorter time, but the necessary results would not be obtained. Since this short route was first spoken of it has been tried by Mr. Wellman, and by the Duke of Abruzzi, and now our American cousin, Mr. Evelyn Baldwin, is making an attempt on similar lines; and if he is prepared to spend the whole year there is no doubt he may reach the Pole.

I intend to take a crew of fourteen men,—including scientists. Fourteen men can handle the boat until we reach the ice and after we get to the ice there is no navigation to be done; the only work then will be to get in the leads, to cut channels and to keep the vessel free from ice. The first year we will have nothing to do but to keep the ship free from ice, and prepare her for wintering and look after her generally; at the same time taking soundings and whatever observations there are to be had. I intend to take photographs to show the formation of the ice; of the aurora borealis and of the moving ice. We will also have a graphophone to register noises made by the ice and at the same time register the noises made by any one of our party who gets in the blues, so that later, when we come back, we will be able to say, Mr. So and So on such a date had the blues. By doing this it is altogether likely no one will have the blues.

PLAN OF PROPOSED EXPEDITION.

Approved by the Québec Geographical Society.

I propose to build a special vessel about 300 tons register, and to have a party of scientific men, and the best seamen obtainable.

Guided by the experience of Capt. De Long, Dr. Nansen, Prof. Nordenskjol, Prof. Baron Toll, Sir Clements Markham, and other eminent men of England and America, I believe that we can undertake this voyage with certitude that the result will be of some benefit to our fellow-men, and to science and commerce in general.

We hope to sail from Vancouver or Victoria, calling at St. Michael, or Port Clarence, to send our last dispatches and take in the balance of our stores.

Entering the Strait of Behring in about July, following the Coast of Siberia, and entering the ice between 170 to 165 degrees east as its state may permit, we will push north as far as possible in August and September, dropping buoys with records at intervals to test the ice drift. We propose to send one small balloon messenger every month with records, when the wind suits, so that the world at large may get news of the expedition. Every balloon will have a copy of the records sent in the former balloons. All possible photographs of everything we see will be taken, using kites for taking long distance-photos, so that we can see in fine weather the leads. Soundings, dredging, and other scientific observations will be recorded.

Once in the hands of Jack Frost, we would prepare for the worst; with suitable appliances, it is known that we can run long distances on the packed ice, during its proper season.

In our second spring and summer we would make two different routes, one in the north-east direction, and the other in a south-west direction, with stations at different places, so that we can keep in communication with the ship with wireless telegraphy and gun-signals when weather permits. These two different routes will be staffed at every mile. The staffs will be hollow, and part of them filled with condensed provisions, each one bearing a number and record, so that the passage of each party will be recorded. At the 50 mile station, soundings and weather records will be taken at intervals, and other observations.

When in the neighborhood of the Pole, the N.E. route will be extended to one or two more stations, as we may require, always being in communication with the ship and the stations. In this way I think we can reach 90 degrees North with certainty.

We know that dogs are the horses of the Arctic, and we shall have a small number of them, just sufficient to haul our material and stores. Having three years before us, we may count on a natural increase in the number. We must have also several boats.

A boat in section in case the ship will be lost.

But some of these boats are small and portable, so that they can be used for crossing openings, which are many sometimes, but as we are not in a hurry we can take our time to get along. We know we have our ship to fall back upon at any time when necessary. In all directions in which man has penetrated to the uttermost northern point of the north he has met the sea.

Will Great Britain and Canada reap this fruit, or shall we allow other countries to anticipate us?

It is Canada's most northern limit, and we are bound in our own interests to attempt it.

We Canadians are willing to sacrifice a good deal and I hope will undertake it.

What we learn from the Mother Country we are ready to return with interest, and what a grand voyage it would be to start from Canada via the North Pole to England, coming back with a precious cargo of records of the unknown part of the Polar regions.

Our friend, Commander Scott, with the "Discovery" will do the same in the Antarctic Sea. If I turn my back to Capt. Scott on leaving, I hope it will only be for a short time when we shall meet again, each with a fine record.

I must say here, that in 1896 I proposed two plans. Plan No. 1, by the Strait of Behring, and Plan No. 2, by Franz Joseph Land to the Pole, and returning to Spitzbergen, but the Quebec Geographical Society preferred Plan No. 1, because it would bring better results.

To quote the words of Sir Clements Markham, President of the Royal Geographical Society before the Royal Geographical Society, London, May, 1897.

"There is, however, still much to learn. An expedition should be sent up Jones Sound to connect the 400 miles between Prince Patrick Island and Aldrich's furthest, and to examine the line of ancient ice in that unknown region. Another expedition should complete the examination of the northern side of Greenland. A third should be equipped on Nansen's plan, and sent to carry out Nansen's principle, by commencing the drift much further to the eastward, and passing over the Pole itself. This would probably occupy 4 years, but it would bring back a further instalment of knowledge of the vast unknown area and another series of magnetic observations. It should also decide the question of the existence of land between Prince Patrick and Wrangel Islands. It is true, therefore, that much remains to be done. Still, we have a large mass of facts respecting the Polar regions, from which scientific deductions may be drawn, and this has been enriched and materially increased by the labors of Dr. Nansen and his gallant companions."

In May, 1898, Dr. Nansen proposed a new route to reach the Pole and described how the Pole will be reached going by the Strait of Behring, by commencing the drift more to the eastward.

Allow me to give you a few views relating to your humble servant.

Here is the old City of Quebec, at one time the cradle of shipping in Canada, and so well represented at the Federal Government, by our Premier, Sir Wilfrid Laurier, and the Hon. R. R. Dobell, and the Honorable Solicitor-General, Mr. Fitzpatrick.

Next, my house in Canada—but let me tell you the home of the sailor is the sea, and he should be at home and contented everywhere.

Your humble servant's library at home.

"Man proposes, and God disposes." No matter what his rank or position may be, the lover of good books is the richest and the happiest of the children of men.

Having left home at the age of 12, I had not the opportunity to learn very much; finding that I was at a discount with my fellowmen, I made up my mind to study and pay for my own learning. I am very ignorant yet, but I mean to learn more.

"Knowledge, the wing wherewith we fly to heaven."

—(Shakespeare).

I am lured by no hope of gain, influenced by no spirit of conquest, but I am moved solely by the belief that man should know even the most desolate regions of his abiding place, the earth, and with the determination that the British Canadians shall do their part.

The globe is a chartered ship for the future, and richly loaded. The earth was made for man to utilize for his own good, and God gave him his own free will to go where he likes. Some men stop on the way, some go farther and farther, and it is a race to see this earth and to find our wants and pleasures.

My Motto:—

"Aime Dieu et va ton chemin"—"Love God and go thy way."

The greatest part of our knowledge comes from the Mother Country and old Europe; you can see the sun rising in the east, that means knowledge. "If we studied nature more we would succeed better." For everything on earth is for us. We have only to help ourselves and make the best of it, and the unknown Arctic area is well worth the having for purely practical purposes if for no other, because the available wealth of this northern world is by no means exhausted.

With your kind permission I will show you, so that you can know me better, a sketch of my forefathers which will show you that the spirit of the Navigator has been thoroughly instilled into your humble servant.

My grandfather (Capt. J. B. Bernier), at the age of 86, having commanded over 50 years.

Jean-Baptiste Bernier, a pilot for 53 years in the River St. Lawrence, at the age of 80.

Capt. Joseph Bernier, at the age of 71, was master for 40 years.

Capt. Louis Bernier, at the age of 60, in command of the Revenue Cutter, "La Canadienne."

Captain Thomas Bernier (my father), at the age of 70; he was master for 43 years.

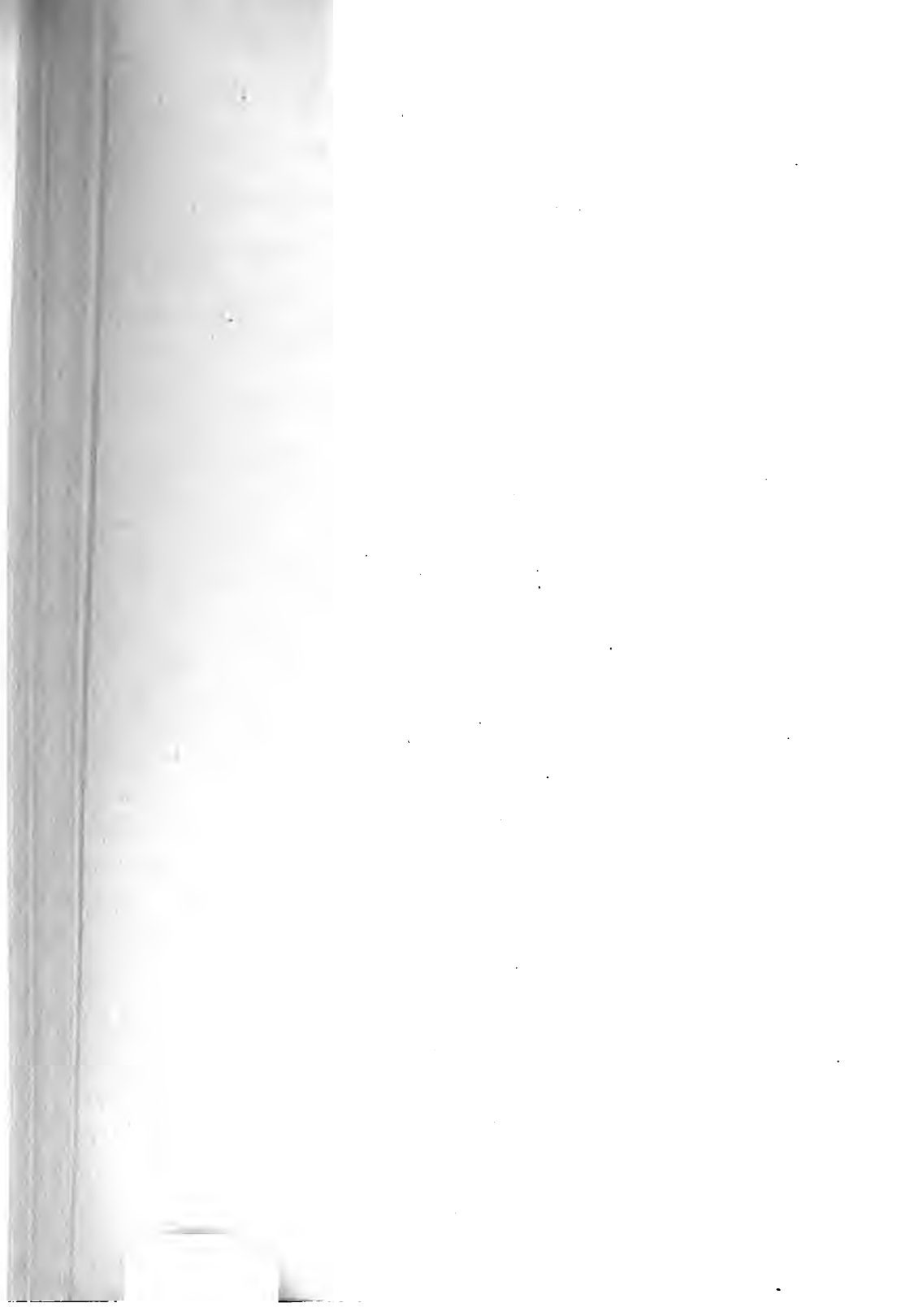
Capt. Joseph E. Bernier—your humble servant. Master of the Deep Sea Vessel at the age of 17.

Your humble servant who has undertaken to sail from the Strait of Behring towards the Atlantic, for a scientific voyage, and to attain the highest possible latitude. I now offer my services to Canada.

Mr. President, allow me to thank you most gratefully for having honored my lecture by your presence.

Gentlemen of the Association of Ontario Land Surveyors, I also thank you for your kind attention.

Mr. President and Gentlemen of the Association of Ontario Land Surveyors, I thank you for the privilege you have given me of addressing you to-day, and for the sympathetic and intelligent interest you have shewn in the subject on which I have spoken.



[This Association is not responsible as a body for any opinions expressed in its Papers by Members.]

LEVEL OF LAKE ERIE.

BY F. W. FARNCOMB, O.L.S., LONDON.

The necessity for increasing the safety, certainty, and facility of the navigation of the Great Lakes and the Deep Waterways between them and the Atlantic tide waters, is one of the great undertakings of international importance which will require the immediate action of the Canadian and the United States Governments. The comparatively great variation, both annual and periodical, in the height of the water, in Lake Erie alone, involves enormous loss to the shipping interests as well as the expenditure of millions of dollars in deepening harbors, channels and waterways.

How to regulate or minimize this variation is the subject of a special and exhaustive report by Mr. G. Y. Wisner, a member of the United States Board of Engineers on Deep Waterways, from data gathered by this board, and endorsed by his colleagues, as a preliminary report upon the whole subject to be investigated, for which the necessary data and conclusions have not been completed. Records taken at Cleveland since the year 1865, up to the year 1898 inclusive, show that the mean elevation of the water in Lake Erie above mean tide at New York is 572.4 feet, and using the same datum, the highest mean monthly water mark, which was reached in 1876, is 574.3 feet, and the low water mark, reached in 1895 and 1896, was 570.6 feet. The greatest variation in the height of the water in the last thirty-five years was therefore 3.7 feet, and the mean annual variation, which continues about the same in recent years, is about 20 inches. The chief source of supply to Lake Erie is drawn from the great lakes above, which, with their respective watersheds, include an area of over 150,000 square miles, or about six times the area of Lake Erie and watershed; it is therefore the fluctuation in the supply from these lakes due to varying rainfall, ice, etc., which practically governs the variation of its water level. The flood water, pouring into the upper end from the Detroit River, the lake water at normal height must rise until the sectional area and slope of the upper portion of the Niagara River, which forms the outlet, is increased till its

capacity is equal to the increased supply from above, when the lake water level becomes once more stationary until the conditions are again changed.

It is evident that no matter what system be adopted for regulating the water to a uniform height, or in other words making the discharge equal to the supply, that the capacity of the Niagara River must be increased below the required lake level so that it will at all stages be sufficient to carry off the maximum supply. It is also evident that this can only be accomplished by deepening or widening its bed for a certain distance, or by raising the water in the lake above the river bed until a like result is obtained. With this result accomplished, by either method, means must be devised to regulate the discharge into this huge tail race, when its full capacity is not required, so that it will equal the volume of water flowing into the lake. This can only be done by means of a dam and flood gates in either case. For economical reasons alone, therefore, the scheme recommended for raising the water to or near high water mark, seems to be the proper one, apart from all important questions of the actual height which will be most convenient and beneficial to the majority of interests that will be affected.

By means of accurately measured cross sections of the river and careful observations taken at different stages of the water level, the volume of each mean monthly discharge from the lake has been accurately determined from the year 1865 to the year 1898 inclusively, and from these results the necessary height of the proposed submerged weir and width of sluice gates have been calculated, which fixes the height to which the water will have to be raised and maintained at 574.5 feet, or a little over 2 feet above the mean elevation and about 2 inches over high water mark for the period referred to, which was reached in the year 1876. The location chosen for the proposed fixed weir and sluices will follow a rock reef which extends into the river from the break-water of Black Rock Harbor, Buffalo, for a distance of about 1,300 feet and then deflecting about 35 degrees northerly, and running in at right angles to the Canadian shore, a total distance of 2,810 feet. Of this 1,600 feet will be a fixed weir, 1,040 feet will be sluice openings, and the remainder will be taken up by sluice gate piers. About 1,200 feet of the reef will be utilized at a small cost for the proposed weir as it is about the required height, viz.:—6.6 feet below the surface of the water when regulated to the height proposed. The river bed deepens suddenly at the end of this rock, and it is from there the piers and

sluice gates will be placed. They will be 13 in number, 80 feet each in width, and have a depth of 20 to 24 feet. To each gate will be attached suitable hoisting gear, and counter weights so arranged that the variation in weight due to immersion will be so equalized that the hoisting gear will only be required to overcome the friction, etc. So nicely will this adjustment be made, that it is stated two men only will be required to operate each sluice and the whole system will be opened in three quarters of an hour. The piers, 52 feet long and 12 feet in width will be built of concrete faced with granite, and paving stone will be carried up $9\frac{1}{2}$ feet above the water and upon these the steel superstructure, 40 feet in height, to carry the weights and hoisting gear will be placed. The weir will be made with concrete, 5 feet wide on top with rounded crest with upper side sloped one to one, the lower side vertical, and both sides filled in with large stones. The foundation is upon rock-bottom throughout.

In calculating the discharge in the last 35 years, it is estimated that the mean monthly discharge was 220,430 cubic feet per second, and the greatest mean discharge for the first six months (which occurred in 1876), 285,200 cubic feet per second. The volume of discharge over the weir with the water at 574.5 feet will be 113,400 cubic feet per second, which can be increased at will up to 159,500 cubic feet per second by opening the sluice gates and making the total discharge 272,900 cubic feet per second, exceeding by 1,900 cubic feet per second, the average supply for the storage season for any year excepting 1876. But it is pointed out that in the last 6 months of the year the discharge was 60,000 cubic feet per second less than the capacity of the proposed regulating works, which could then have lowered the water one foot in two months, and that this contingency, as well as those in the future, could be readily dealt with by lowering the water sufficiently during the season of limited supply, after navigation closes.

In conjunction with this work a channel and lock will be necessary on the Buffalo side of the river to a point below the gorge where it widens and the current is slower, in order that vessels may pass around the works and at the same time do away with the present dangers and difficulty in navigating the shoals and swift current in this part of the river. The estimated cost of the regulating work is about \$800,000, while the cost of the 17 foot channel and lock, 600 feet by 60 feet by 21 feet, is estimated at about \$1,600,000, or about \$2,400,000 in all. The probable effect of the proposed works upon the lakes and waterways above

and below is also one of great interest and importance. Perhaps the latter is more particularly so to Canada, for any further lowering of the waters of Lake Ontario and the St. Lawrence River would almost amount to a national calamity. While the report is not conclusive upon this particular point, the investigations in that respect not having been completed, it is claimed that regulation will not materially change the annual discharge through the Niagara River, and will only modify the distribution of flow about 5 per cent. of the average discharge, and therefore cannot materially affect the level of Lake Ontario and the St. Lawrence.

It seems that through the deepenings of the channels of the St. Clair and Detroit Rivers in recent years, the low water levels of Lakes Huron, and Michigan have been lowered one foot. It is estimated that the direct result of raising the level in Lake Erie 3 feet will be a corresponding rise of 2 feet in Lake St. Clair and one foot in Lakes Huron and Michigan, thus restoring to the latter their former natural low water level previous to the year 1886, and at the same time diminish the fluctuations of these lakes one foot. It is shown also in favor of this scheme that the aggregate cost of improving Lake Erie harbors alone has averaged \$1,000,000; for every foot in depth of permanent improvement, and also that the enlargement of the navigable channels of the St. Clair and Detroit River to a width of 600 feet, is at present a matter of urgent necessity, and the favorable effect that the proposed work would have in this instance also is apparent. The report states that the stage at which the lake level would be regulated, that is with an elevation of 574.5 feet above mean tide water, would be 6 inches below high water mark, but the date upon which this height was reached does not appear to be given.

DISCUSSION.

Mr. A. R. Davis:—I think we are deeply indebted to the writer for this paper on a subject that has arrested the attention not only of our Engineers but of the American Engineers. The Deep Water Ways Commission, composed of eminent Engineers has been looking into the matter of the water levels of the Upper Lakes now for several years. And we know that the canal at Chicago has been a question of grave fear on the part of the Engineers in reference to the levels of the Upper

Lakes. We hear now that the complaint of the people on the Mississippi River is that the sewage of Chicago is being carried down the Mississippi and is very gravely interfering with the purity of the water. That of course indicates the drainage of the waters of the Upper Lakes to the westward and southward.

An important question with us here is the level of Lake Ontario. If a dam is thrown across the Niagara River it will interfere with the discharge to a greater or lesser extent and consequently with the levels of Lake Ontario. The writer of this paper points out that difference in discharge is going to be very slight. I think he says it would be only some five per cent. I cannot see why such a discharge should be allowed if it is thought necessary to construct a dam there of such magnitude.

This is a question we are all concerned in, and we are indebted to the writer for giving us this very able paper; and I

Mr. H. H. Gibson

There is one point mentioned by the writer of the paper that I would like to speak of. He says that Lake St. Clair, Lake Huron and Lake Superior—and I suppose Lake Michigan—would be raised one foot each in their level. Can any one here explain how it could occur, that the level of these Lakes which run into Lake Erie with a fall from each river would be raised.

Mr. A. R. Davis:—He claims that by raising the level of Lake Erie three feet at the bottom you would raise the level of Lake Michigan one foot.

Mr. H. H. Gibson:—Is there only that much fall in the River?

Mr. A. R. Davis:—That is the inference.

Mr. H. H. Gibson:—Yes, but I thought it was more than that.

President Ross:—This paper is founded on a preliminary report only. The Deep Water Ways Commission has been taking soundings and obtaining information, and are doing so still, since the date given here of this preliminary report. I have seen them myself at work there with a tug in the River. This report deals with what is called damming the Niagara River, a thing which people many years ago thought was a preposterous proposition. When the final report of this Deep Water Ways Commission is published there will be a great deal more information given. One point that Mr. Farncomb has not taken into consideration,

this is, the action of the wind on Lake Erie. When there is a strong south-west wind the water is piled up there to the easterly end of the Lake, at Buffalo and all along the Canadian shore, and at Port Colborne, and towards the easterly end of the Lake. The water rises very materially, perhaps two or three feet; and then the Niagara River rises in the narrow places; just below the Falls, perhaps it will rise 15 feet in one heavy storm. This paper deals with Lake Erie as if it were a mill-pond that the wind did not affect very much. But the action of the wind really affects Lake Erie very considerably.

Mr. A. R. Davis:—Who is concerned in the construction of this dam?

President Ross:—The Deep Water Ways Commission is a United States Government Commission. There was a joint meeting of Canadian and American Commissioners, but I think what is being done now is being done by the American Commissioner altogether.

There is another point that Mr. Farncomb has not touched on, that is, the damages that would have to be paid to the owners of lands in the vicinity of Lake Erie. There is a large acreage of comparatively low lands in the vicinity of Lake Erie that are only about three or four feet above the average level of the Lake; these lands are now cultivated and drained and if Lake Erie were raised nearly four feet vast tracts of land would be flooded and there would be quite a bill for damages.

The idea of raising the level of these Lakes is quite a good one; I suppose it is easier to raise the waters of the lake than to be continually deepening the waters of the harbors as has to be done in view of the fact that boats of much greater draught are being used now, boats of twenty feet and probably a greater draught have to come into our harbors. Port Colborne Harbor is being deepened now by the Dominion Government to a depth of twenty feet although the canals are still only fourteen feet in depth.

Mr. H. H. Gibson:—Was not the intention in building this submarine weir to raise it to a normal level, not to raise it beyond the original height that they suppose the lake stood at? In that case there would be no damages.

President Ross:—I do not know about that; you might have to go back into the history of the lake.

Mr. H. H. Gibson:—I mean of recent times.

President Ross:—Not that anybody remembers.

Mr. H. H. Gibson:—I thought that was the intention all through the paper.

President Ross:—There is a great area of land now cultivated that could not be cultivated if the lake were raised; and the people who are making a profit off that land would be, I think, entitled to damages. However, that is a question for the lawyers.

Mr. H. H. Gibson:—They are probably using land that belongs to the Government.

President Ross:—No, this land is above the average high water mark. I do not suppose high water mark would mean the highest level.

Mr. H. H. Gibson:—It would not mean flood water.

President Ross:—That is, water piled up by the action of the wind?

Mr. Gibson:—Yes.

President Ross:—No, it would not mean that. Of course high water mark is very difficult to define.



[This Association is not responsible as a body for the opinions expressed in its Papers by Authors.]

SURVEYING BY PHOTOGRAPHY.

BY J. N. WALLACE, O.L.S., D.L.S.

Considering the fact that Canada possesses in the Rocky Mountains some of the most difficult country in the world to survey, it is strange that even amongst surveyors, there should not be a more general knowledge of the method known as photographic surveying, which is so well adapted to rugged districts. This method is of interest not only to surveyors but to photographers as well, for the latter can fairly claim that by its use surveying has been added to the already long list of sciences which are indebted to the art of photography. There can be little doubt that the general want of knowledge of the method is due to the mistaken idea that its practice is involved in mathematics. No doubt some effort is required at first, to realize the general relations of a photograph to the actual country, but the theoretic knowledge necessary for the practice of surveying by photography is not very extensive nor difficult for a surveyor to acquire. It must not be supposed that proficiency in the practical art is so easily gained, for its difficulties are such that natural aptitude and a large experience in the field are necessary to overcome them.

The use of photography for surveying purposes is much older than is popularly supposed. So far back as 1860, the idea was practically developed by Colonel Laussedat, but its use has been very restricted. Surveys to a small extent have been carried out in several European countries, notably in the Italian Alps, where the lower parts of the mountains have been surveyed by the plane table and the higher altitudes by photography. None of these surveys, however, approach the extent of the Canadian surveys. Under the direction of Mr. Deville, the Surveyor-General of Dominion Lands, who originated the use of the method in Canada, photographic surveys already have covered over 25,000 square miles in the foothills of the Rockies and in the mountains themselves in British Columbia and the Yukon. These were commenced in 1887 and have been ex-

tended almost every year since then. The foothills surveys include the area between the prairie and the Rockies, from Calgary southwards to near Macleod, covering about 2,000 square miles of country varying in altitude from 3,600 to 8,000 feet. These surveys are plotted with great detail, and are used in connection with irrigation works. About 20,000 square miles of the boundary country between Canada and Alaska have been surveyed in a preliminary manner, and besides extensive surveys along the railway belt in British Columbia, photography has been applied to the survey of part of the country forming the north boundary of British Columbia, and more recently to the survey of the celebrated Crow's Nest coal area.

The photographic method receives its best application in the survey of mountainous districts, for the very ruggedness of such countries, which proves a barrier to ordinary methods of survey, is itself an advantage when we use photography, as it affords stations from which commanding views can be obtained. The chief characteristic of the method is its ability to make a rapid record of the positions of inaccessible points, and hence the more inaccessible and numerous these points the more fully are its advantages developed. There are, however, cases where it can be well used apart from mountains, when we wish to make a survey of anything lying in one horizontal plane or nearly so, which can be overlooked from suitable stations. Such cases may occur in the survey of a rocky coast-line, the shores of a lake, the windings of a river in a deep valley, etc. In such cases, by means of the perspectometer instrument, we can deduce the horizontal plan from the vertical photograph very easily and rapidly.

In considering the general principles of photographic surveying, it may be well to first of all point out the relation existing between the positions of objects in a country, as seen from a camera station, and the positions of the corresponding points in the photograph. We may suppose a surveying camera, so levelled that the plate is exactly in a vertical plane, to be set up on some mountain peak, and a view to be taken of a range across a valley. We know that an image of the distant scene is formed, by the lens, at a distance behind it equal to its focal length, that is, on the sensitized plate. We also know that the points in this image are so situated that a line drawn from any object to the so-called centre of the camera lens and continued onwards will pass through the corresponding point in

the image. Considering a whole series of such lines drawn from the various objects through the centre of the lens, we may regard the image on the sensitized plate as consisting of the points of intersection on the plate of all the lines of sight from the centre of the lens to the objects in the landscape.

We may now suppose a transparent screen to be placed at a distance, in front of the centre of the lens, equal to its focal length, and to be exactly parallel to the sensitized plate. The eye placed at the position of the lens and looking through the screen would see the landscape as it were projected on the screen. Such a picture, being formed by the intersection of the various lines of sight on a plane parallel to the plate and equally distant from the centre of the lens, would therefore be exactly similar to the image on the plate. We could, therefore, replace the picture on the screen by superimposing a finished print taken from the negative. By imagining lines drawn from the centre of the lens to the print so placed on the screen, we can realize how it is that a photograph gives a graphic record of the different lines of sight to all the visible objects, as seen from the camera station.

In order to make use of this record we must have some basis to work on. In the case of every photograph, in addition to the known focal length, which is constant, we must know three things. Firstly, where is the horizon line, that is, where would a horizontal plane through the centre of the lens have intersected the negative while the photograph was actually being taken. Secondly, we must know where the axis of the lens (that is, "the line of sight" of the camera) intersected the negative. This is called the principal point and is always on the horizon line so long as the plate was exposed vertically. A vertical line across the negative through the principal point is called the principal line. These two lines quarter the negative. As the screen picture is similar and similarly placed to the negative, these lines will occupy similar positions on it. Lastly, we must always know the absolute azimuth of the line of sight of the camera for each exposure. While in reality the picture of the landscape is recorded behind the lens, it is much easier to grasp the general principles if we suppose it to have been recorded on the imaginary screen placed parallel to the plate and in front of the lens.

There are very many forms of cameras for surveying purposes, which may be roughly classified as those which are simply

cameras, and those which have in conjunction some means of measuring horizontal or vertical angles or both. The Canadian Camera is of the first class, so that it is always accompanied by a second instrument to measure angles. Generally a 3-inch transit fitting on the camera tripod is used, and angles are measured immediately after the views have been taken by simply replacing the camera by the transit, without disturbing the tripod. The camera itself consists of a plain rectangular box, with no focussing arrangement, being composed of a metal framework, surrounded by mahogany. It can be used, like ordinary cameras, either with the long edge of the plate horizontal or vertical. On two adjacent sides are a pair of levels at right angles, one of each parallel to, and one transverse to the line of sight of the camera. One pair is always on top and the other pair neglected for the time. When a plate is exposed it is pressed against a rectangular metal border in front of it. In this frame, appearing in every print as a black border, are four small nicks in the approximate centre of the four sides. These nicks are so placed that the lines joining opposite pairs are at right angles, and their intersection is at the principal point. The placing of these nicks to fulfil these two conditions is of the nature of a permanent adjustment, and will not be discussed here. With the nicks so placed, the camera can be levelled so that a horizontal plane, containing the axis of the lens, will pass through the nicks. The principal line must then pass through the top and bottom nicks. As the spirit levels cannot be adjusted in the usual way, being fixtures, it is necessary to find instead the position which the bubbles must occupy in the level tubes, when the two side nicks inside the camera are horizontal. The levels parallel to the line of sight have only one function, namely, to place the plate in a vertical plane, one level being used for each position of the camera. The position of the bubble in each of these levels when the plate is vertical is found, at the commencement of the season's work, by an experiment somewhat analogous to that by which the zenith can be found in an astronomical observatory. Having been once found, the bubble is always placed in the same position, and we know that the plate is vertical whenever an exposure is made. The position of the bubble in each of the transverse levels, when the nicks are horizontal, is also found once for the season's work. When the bubbles have been so placed at every exposure of a plate during the course of the survey, we know that the horizontal and principal lines must have passed

through the nicks, and we can at once so draw them on the prints subsequently made.

If the proper position of the bubbles were not known during the survey, we need only assume positions for each of the four levels. These being used throughout the survey we can subsequently, by an experiment, find the positions of the horizon and principal lines, relatively to the nicks for the particular placing of the bubbles used throughout, and then draw these lines in similar positions for all the prints.

There is therefore no practical difficulty in drawing these lines on the prints, for they are at once drawn in similar positions for all the prints. Their positions can, however, be independently checked for each separate print, if required.

The finished print with the horizon and principal lines drawn on it in their correct positions, may now be supposed to occupy the place of the screen picture in front of the camera lens in the field. Each point in the print is now exactly on the line of sight from the lens to the corresponding object. Every object whose image lies on the horizon line of the print has the same apparent elevation as the lens, and from the distances of the other image points above or below the horizon line, we can deduce the altitude of the object relatively to that of the station by the principle of similar triangles. By drawing verticals from each point to the horizon line, we have a series of points along that line which gives the horizontal angles between the lines of sight to the objects. The azimuths to these various objects would then be all known if we knew the azimuth to one. This is found, for each view, by setting up the transit and reading the angles to at least one prominent object in each view, such as an isolated peak, which can be recognized subsequently in the print. At the same time a reading being taken to one of the other triangulation stations, we have the azimuth of each of the "orientation" points selected in the views. When the print is made, we first recognize the point we selected in the field, and then draw a vertical from it to the horizon line. From the position of the foot of this perpendicular, relatively to the position of the principal point, we can deduce the azimuth of the principal point itself, by a graphic construction.

From what has been just said, the method of plotting the survey will be apparent. The triangulation and camera stations being laid down on the plan in the usual way, a line is drawn

from the camera station in the direction of the line of sight of the camera when the particular photograph was taken in the field. On this line a point is marked at a distance from the plotted station equal to the known focal length, and here a second line is drawn perpendicularly. This last line has now the same relation to the plotted camera station, both in distance and orientation that the horizon line on the screen picture had to the centre of the lens in the field. By laying off on it the same series of points as we obtained from the verticals on the horizon line and drawing lines from the plotted station to these points, we have a series of lines representing the azimuths to all the objects selected. The same procedure being gone through for a second photograph, taken at another station and including the same points, gives a second series of radiating lines. Corresponding intersections finally establish the positions on the plan.

The prints are enlarged in the linear ratio of 2.1 to 1, forming prints about 13 inches by 9 inches. In the metal border, surrounding the plate, the focal length is exactly marked off, so that, by this ingenious arrangement, this length is similarly enlarged when the print is made. It is really this enlarged focal length, or "distance line," which is used when plotting the plan, thus preserving constant the ratio between the distances apart of points on the negative and the actual focal length. The effect of enlarging a print is the same as though the screen picture was moved proportionately far away from the lens.

As the points are plotted by intersections of lines of sight to the same points from two stations, similar points must be recognized in two views. This matter of identification is easy or difficult according to the angle between the two lines of sight, the nature of the scenery and the quality of the photographs. When the relative positions of points in two photographs are much changed, the only way is to regularly follow similar ridges in each print, the identification of one point then leading to another, and so on. In this way many points can be recognized, which could not be done, if we proceeded in a haphazard way. Both the ability to select points capable of identification, and identification itself are largely extended by practice.

A sufficient number of well-selected points being plotted, the elevations of all or some are found relatively to the camera station, by the principle of similar triangles. The elevation of the station having been found by trigonometric levelling,

a simple addition or subtraction gives the absolute elevation. We now have the positions and elevations of the salient points, and proceed to draw the contours by interpolation for every 100 feet or 200 feet as the case may be. Plans of mountainous countries consist almost entirely of these, and the watercourses. Enough points cannot be accurately located on the plan to draw the contours by these alone. Whatever the method of survey, the smaller details must be drawn by estimation. For this reason, in judging different methods, a great advantage must attach to that method which enables the topographer to estimate most closely. Photography has here a great advantage over its rival the plane table, for by having two or more photographs showing the country from different points of view to which he can refer as often as required, the topographer can arrive at a very much truer knowledge of the details than when using the plane table, which is restricted to one point of view at a time.

On the other hand it is claimed that it is easier to contour details with the actual country before you than from a photograph. In this connection it must be remembered that what we see, when in the field, is little more than a perspective. It is by our knowledge of the laws of perspective (probably acquired unconsciously) that we derive nearly all our ideas as to what would be its horizontal plan, when we look at a view, whether the view is a landscape or the interior of a room. It is true it is difficult to represent on a horizontal plan what is presented to us on a vertical photograph, but it is also true that our own eyes can only see the projection in the field, and similar difficulties arise when contouring there. With a photograph, whose distance line equals the distance of distinct vision (about ten inches), the sizes of objects as seen in the photograph are the same as their apparent sizes when we look at the landscape itself. It is only in lack of brightness and definition and want of coloring that a photograph is inferior to the actual view.

It must be admitted that here we have perhaps the greatest objection to the photographic method of surveying, for it is not possible, in the present state of science, to obtain a photograph as clear as the actual view, and it is often difficult to get even good photographs at all. Beside the usual defects of all lenses, plates and prints, the defects of the weather are peculiarly trying to a surveyor. He must largely take it as it

comes. The weather may be bad for days, or it may occur that, after a laborious climb to some peak, the day, which promised well, may suddenly change, and the surveyor must either take the photographs under poor conditions or else lose a day. Almost any defect in the weather has a worse effect on photography than on natural vision, and so long as this is so, an objection can always be urged against this method of survey.

Unfavorable weather conditions are caused by want of sunshine, fog, smoke in some localities and the blue haze at high altitudes. The last is partly neutralized by placing an orange glass in front of the lens. This stops the blue light diffused by the atmosphere, so that the light which reaches the plate is that coming from the objects themselves and not that originating in the intervening air. Such a screen has the bad effect of markedly increasing the shadows, for objects in shadow are nearly entirely illuminated by the atmosphere and such light cannot pass the screen. The result is that a valley in shadow shows up poorly, unless the extreme limit of exposure for the bright lights is allowed.

The time of exposure is a difficult matter to decide, varying greatly with the light, the scenery and the altitude. The effect of a particular light on eyesight is not a good test of its effect on a photographic plate, especially behind an orange screen.

The Canadian Camera is carried in the field in a box also containing a dozen plates, the whole weighing about twenty pounds. Single plateholders are used, and the plates changed at night under a canopy hung from the inside of the tent. An arrangement by which plateholders could be re-filled in daylight would be a great improvement, saving the surveyor the alternative of having to come down to his camp in the valley each night, or else having to carry a special tent up the mountain. Cramer's isochromatic plates are used, $4\frac{3}{4}$ in. x $6\frac{1}{2}$ in. By isochromatic is meant a plate which is sensitive to the different colors more in proportion to their illuminating effect than is the case with ordinary plates, which are almost entirely acted on by the non-luminous rays. Such plates give results more nearly approaching the effect of natural vision. The lens is a Zeiss anastigmat, consisting of two doublets, with an equivalent focal length of $5\frac{3}{8}$ inches. The enlarged prints therefore have a distance line of about twelve inches, a little greater than the distance of distinct vision. The stop used is F 36, a

slightly smaller stop than No. 64 in the "Uniform System." The enlargements are made on bromide paper. On account of the small stop, the orange screen, and the slow plates, exposure is long, varying from fifteen seconds for a midday sun in June to as much as three minutes for a dull day later in the season. The scope of the lens is such that seven views give a complete circle, with a small overlap for each.

The preliminary triangulation work in a photographic survey does not greatly differ from that usually employed. The triangulation stations being on high peaks, usually afford good camera stations, and they in addition to others are so used. A sharp peak offers the best site. Flat topped mountains, especially if timbered, are very objectionable. If they exist only in isolated groups they may usually be surveyed from camera stations situate on more favorable neighboring ranges. It is a general rule that a ridge is not surveyed by camera stations on itself.

With regard to the distance which may be safely included in a view, this will depend on the state of the weather and the detail required. Speaking generally, sufficient detail for a good plan of a rugged country can be obtained if the points are not over three miles away. Greater detail would be unnecessary in the survey of rugged districts. The principal shoulders and the watercourses down the sides of the mountains can be well plotted from good photographs up to six miles. Beyond that we can only expect to obtain a general idea of the country. The position of the camera stations, however, is more often described by the necessity of seeing up valleys beyond intervening ridges, than by the question of how far the details can be made out. Every part of the country must also be covered twice, from two stations whose distance apart forms a suitable base. It must be remembered that although we may be able to see points in a photograph up to six miles, it does not follow that one camera station can survey a circle of six miles radius. Around each camera station there is always a large space too close to be surveyed. When points approach the base line between two stations, although they may be clearly seen in the photograph, the lines of sight to them from the two stations make too obtuse an angle to allow of proper identification. Identification, even with good photographs, is difficult and involves much loss of time if the lines of sight to the points intersect at a greater angle than forty degrees. The aspect of the country is

is much altered in the two photographs to allow enough points to be identified. If we imagine a segment of a circle containing an angle of forty degrees to stand on the line joining two camera stations, it is easily seen that the lines of sight to all points in this segment intersect at a greater angle than forty degrees, and the whole area of the segment is poorly surveyed. This area must be doubled for the two sides of the line. With camera stations distributed over a country at approximately equal distances apart of five miles or so, these unsurveyed segments may become very great, and almost neutralise any attempt at a detailed survey. Had the same total number of stations been placed in pairs, a couple of miles apart, with a much longer interval to the next pair, a very much better survey would result. This is a matter very apt to be overlooked in a photographic survey. It may be remarked that the absence of a record of what has been covered by the photographs taken is much felt in the field. Not only must the surveyor recollect what has been covered, but whether it has been covered twice from suitable stations, a difficult matter in a country whose aspect is much changed as we go from station to station.

The field notes of the photographic part of the survey consist of a record of the number of the plate exposed, the extent of country covered, the time of exposure, kind of light, and such remarks as may be useful. The magnetic bearing of the line of sight of the camera should also be taken by means of a pocket compass, as a general indication of the direction of the view for office reference.

The chief objections to the photographic method may be considered to be the difficulties of obtaining good photographs, the absence of record of what has been properly covered by the camera, the fact that the country must afford stations overlooking large areas, and finally that a long apprenticeship is necessary in the field to properly estimate exposure, and that advancement in the science of photography itself is necessary to perfect the method.

On the other hand, we have a much shorter time in the field, not only saving expense, but a matter of consequence in a severe climate, and a possibility of surveying countries containing many inaccessible points with greater detail than by any other known method. The fact that a rather long time is taken to plot from photographs is largely due to the camera stations not being suitably arranged to facilitate identification, and to

poor qualities of photographs, both of which impediments can only be avoided by practical experience.

As a practical example of the use of the photographic method of survey, some statistics will be given of the survey of the Crows Nest coal area, on which the writer was engaged last year. This area consists of a group of cretaceous mountains 6,500 to 7,500 feet altitude, surrounded by limestone mountains rising to 9,500 feet. The field work in this survey occupied three months with a party of six, all told, during which 51 triangulation stations and 72 camera stations were established and 336 photographs taken. Of the camera stations, 25 were over 7,000 feet and only 14 below 6,000 feet. The area plotted from the photographs covers 551 square miles, an area of over 15 townships. The contours are shown for every 100 feet, and considerable detail is shown, as the plan is on a scale of 1-30,000, or about 38 chains to one inch. The plotting occupied four persons for three months. The altitudes of the triangulation and camera stations were found by trigonometric levelling, using the levels along the Canadian Pacific Railway as a basis. With the exception of a few traverses of some of the rivers the entire topography has been plotted from the photographs. It may fairly be claimed that this large area of rugged country could not have been surveyed and plotted in the same time by any other method. The survey and plotting were carried out under the direction of Mr. A. O. Wheeler, D.L.S., who has been in charge of photographic surveys for the Dominion Government for the past six years.

In the foregoing outline, the writer has endeavored to give some general idea of the photographic method in the survey of mountainous districts, avoiding technicalities which can only be interesting to those who desire to study the method in detail. Such will find in Mr. Deville's work "Photographic Surveying," a complete account of its mathematical aspect and also a masterly review of the principles of photography itself as applied to distant scenery. Another excellent publication is Appendix No. 110, U.S. Coast and Geodetic Survey for 1897, by J. A. Flemer.

DISCUSSION.

Mr. C. A. Jones:—Are those photographs retained by the

Government or by the person who takes them? The Government should have them, or copies of them.

Mr. Dickson:—I understood last year that ten parties had photographic apparatus and that they returned everything to the Department, even the films. Of course when the Government furnishes the apparatus it expects the results will belong to the Government.

[This Association is not responsible as a body for any opinions expressed in its Papers by Members.]

THE CANADIAN ASSOCIATION OF CIVIL ENGINEERS AND SURVEYORS.

A. R. DAVIS. B.A.Sc., O.L.S.

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A few years ago I had the honor of submitting a paper before this Association on the subject, "The Field of Civil Engineering."

At present I desire to glance briefly at the broader field of Civil Engineering and Surveying combined, in order to point out a few reasons why, in my judgment, these two branches of one profession should be consolidated into one Society or Association. We are all pleased with the fact that the tendency of late has been in the direction of a closer fraternal union between Engineers and Surveyors. As members of the Canadian Society of Civil Engineers, and of this Association of Ontario Land Surveyors, the thought presented itself to me that by frankly expressing my views on the subject at the present time, when we are stepping out into a new century, a general friendly discussion of the whole matter might possibly be provoked that would materially assist in bringing our Engineers and Surveyors into closer contact and ultimately lead to a corporate union.

In the first place I think we all realize that in the business world to-day, greater success is being achieved through judicious combinations of brains, as well as of material resources. Men are not disposed to hide their knowledge under a bushel, as in the past; but to diffuse it among their fellow-men. This spirit prevails too, in the professional world, where an individual realizes it is utterly impossible to isolate himself from his professional brethren even for a brief period, and still keep abreast of the times.

The tendency of the times is for each individual to pour his small quota of knowledge,—which is certain to be useful to some one else,—into common public reservoirs. These reservoirs are the periodicals and public meetings of the various departments of business, and the several professions. Then from the accumulated wisdom and knowledge deposited therein are drawn such

portions as each individual may require to meet the exigencies of the case, with which, for the time being, he has to deal.

As we are all aware, the medical profession has recently been engaged in breaking down old barriers of prejudice, widening the field of practice to the limits of the Dominion, and elevating the standard generally by a combination of its forces. The same tendency prevails in all the sister professions, including the one with which we stand identified. Civil Engineering and Surveying are complements the one of the other, not only in practice but in theory as well. Throughout the Dominion the two terms are, almost synonymous, and in fact, interchangeable, to those outside the pale of the profession.

A Civil Engineer in many departments of work is frequently called a Surveyor, although he may never have passed a Surveyor's Examination. The day has passed, however, when the Engineer feels any resentment at being called a Surveyor. He has doubtless found from experience that the modern Surveyor knows something more than how to take a meridian.

A Surveyor on the other hand is called an Engineer, by the public, immediately he ceases to run a side line and to take charge of certain drainage, sewerage, or other work. A railway company sends out a party of Engineers to locate a railway. The press in alluding to the fact is quite likely to state that "a party of Surveyors is surveying a railway line from A to B."

Thus we find it in practice. In theory we observe that the several departments of surveying form the most important subject in the curriculum of all the Civil Engineering faculties of our schools and colleges. On the other hand, the several Surveyors' Associations of our Dominion, are more and more recognizing the absolute necessity of compelling aspirants to the profession, to read up and pass examinations on a variety of subjects, which in the past were not regarded as essential in an ordinary Surveyor's practice.

These aspirants are forced to realize that it will be utterly impossible to even eke out an existence to-day as an ordinary old time country Surveyor, let alone to prosper, in his profession. Time was when the Surveyors of this country were kept employed the year round in private practice or Government employ. They usually owned a good farm, well equipped for work, and were regarded as important members of the community in which they resided. The land trials which then occupied the largest part of the attention of the courts invariably had Surveyors pitted against each other; and thus employment in the courts

was a fruitful source of income. The presence of a Surveyor as a witness in our courts to-day is the exception rather than the rule.

Hence the necessity for our young men who are entering engineering or surveying, qualifying themselves for profitable employment in the larger field of our profession, of which surveying is but a part, and of which engineering as heretofore understood is but one important division.

There is a broad field bounded by the Atlantic and Pacific on the east and west, and by the international boundary and the North Pole on the south and north, in which it should be possible for every duly qualified Canadian Engineer and Surveyor to practice where he pleases, none daring to molest or disturb. Now such a condition of affairs would necessitate a change, in some respects, in the government of the profession, and this is the vital point towards which we are aiming. For instance, in civil engineering, we find the deplorable condition of the laws of the United States rendering it practically impossible for a Canadian Engineer to find employment in that country without renouncing his allegiance to Great Britain, and declaring his intention of becoming an American citizen; while on the other hand our doors are left wide open for an influx of American or other foreign engineers immediately any work is started, promising profitable employment. We have had a glaring illustration of this fact during the last few years in British Columbia and other parts of our western country where there has been active railway construction.

These foreigners are not members of the Canadian Society of Civil Engineers, nor have they the remotest intention of becoming Canadian citizens. I believe in reciprocity; but I am thoroughly opposed to this jug-handled policy, as the politicians would say, and I shall do my utmost in the future to have this injustice remedied. Our Surveyors' Association would not tolerate such a condition of affairs for a moment; and I refer to it here merely to show that the Engineers as well as the Surveyors of this country have important changes to make in their regulations before a corporate union can be effected between the two branches of the profession. With regard to the several divisions of Surveyors, we all realize that a closer bond of union might exist than at present obtains; the absence of which necessitates needless examinations, the payment of additional fees, and a material loss of time. Through the influence of this Ontario Association, and kindred

associations, a more cordial and fraternal feeling prevails than ever before, between our various Surveyors and Engineers' Societies, and between the individual members. This *esprit de corps* has undoubtedly been generated and fostered through the prevailing practice of meeting as at present, on common ground, and in broadly discussing questions that concern our profession in a frank, genial manner. Our selfishness and conceit take wings and fly away in the midst of such surroundings. We learn to value the opinions of others although they may not accord entirely with our own. Thus knowledge is gained; and knowledge is power; and the more powerful we become in this sense the more prosperous and useful we will be in our respective communities. We should not rest satisfied, however, with what has been accomplished. A young generation of Surveyors and Engineers is coming up to take our places. As we look abroad we see changing conditions in this country, now in a transition state from dense forest, poor transportation and undeveloped resources, to broad cultivated areas, rapid transit to the remotest boundaries, and the hum of industry on all sides. One of the important results of these changing conditions, to our profession, is the absolute necessity of the Government immediately taking up the question of a thorough trigonometric or geodetic survey of Canada, in order that accurate maps may be prepared, and the physical features of the country laid down with precision.

It is surprising that our Federal Government and Provincial Legislatures, alive to almost every conceivable question affecting our development and prosperity, should remain fast asleep on this most important question, which is now occupying the keenest attention of the Governments of every progressive country in the world.

If a tithe of the millions of our money now being expended on canals, railway bonuses, and public works, were devoted to the beginning of a geodetic survey of Canada, in keeping with the general progress of the times, more wisdom would be exhibited by our legislators than they are manifesting by closing their eyes to so important a matter. It is most unfortunate that our profession is not more strongly represented on the floor of Parliament, and in our Legislative halls. Had we a few enthusiastic representatives, then our governments would soon realize the necessity of a movement in this direction, as well as in several other directions, in which our profession is more or less interested. Who is ready to

sacrifice himself for so laudable a purpose? A geodetic survey of Canada will create at some time in the near future a great field for the employment of our younger Surveyors and Engineers—a field in which they should meet on common ground, and for which our examinations and legislation should, meantime, pave the way for united, efficient work.

While the geodetic survey is in progress in the southerly or more densely settled portion of the Dominion, other Engineers and Surveyors will be engaged in explorations in the great northerly limits of our country; in the building of colonization roads into newly settled districts and the improvement of those in the older districts; the extension of electric railways through the south country, and the construction of steam railways into the timber, mineral and agricultural areas of the north country; and in the execution of large drainage and sewage problems. The Premier of Ontario in summarizing recently the results of the northern explorations of some of our Surveyors last year, and the known resources of the northerly part of this province, and the intentions of the Government with respect to the development of these resources, gives us a hint or intimation of the work in store for our profession in that heretofore practically unknown district; and Ontario is only a fraction of our great Dominion. Let us then be alive to our opportunities, and frame our legislation now so that it will conserve our best interests in the future. If our Engineers and Surveyors were united into one Society, and jointly attended the Annual Meetings, supplying general papers and discussions and if these proceedings could be placed in the hands of every member of the profession, what a library of useful information on every phase of professional work would be accumulated in the course of a few years.

I am aware such a union appeals more strongly to the younger Engineers and Surveyors than to the older ones; owing perhaps to the fact that the latter, as a rule, have settled down in certain comfortable grooves in professional life, out of which they may not care to move. So far as they personally are concerned the present laws or regulations governing their Association or Society answer very well. Many having acquired a competence have no sympathy with the so-called innovations of the younger members of the profession. It has ever been thus in all the avenues of life; and human nature is slow to change; but still changes are continually being wrought. Therefore I appeal particularly to the younger Surveyors and Engineers to support this

movement for the consolidation and elevation of our profession; for they must bear the burdens and responsibilities of the future.

I see nothing inconsistent in a corporate union of Civil Engineers and Surveyors, and the maintenance if necessary, of certain special examinations for special work, such as, for example, topographical surveying, or hydraulic engineering. The latter are chosen from several branches, simply for the purpose of illustration. I repeat, that there is no good or valid reason for objection to a corporate union on the ground that there would be no surveyors qualified for important special work, or, no Engineers trained to cope with the difficult problems of special branches. These questions would adjust themselves quite readily; and we would have the proud satisfaction of realizing that we have become a common brotherhood, bound together and strengthened by corporate and fraternal bonds for all future time.

I do not assume to know all the difficulties that stand in the way of such a union; nor how best to overcome them. Others, doubtless, will, in due time, give these details careful consideration, and suggest ways and means for its accomplishment. I have merely endeavored to show the tendency of the times toward internal consolidation in the various circles of business and professional life; and to make a few suggestions in favor of a forward step in that direction in our own profession. If what I have said is instrumental in drawing out the opinions of others, and leading to a general discussion of the subject, I shall have fully accomplished my present purpose, and will feel amply rewarded,

DISCUSSION.

The President:—Gentlemen, Mr. Davis has given us a very valuable paper on an important topic that I have no doubt all of you will take pleasure in discussing. What he says with regard to the qualification of surveyors and engineers is very true. Any young man now who is licensed, or who passes his examination as a surveyor, has passed an examination on many engineering subjects. In fact, he has practically to qualify as a civil engineer in order to become a surveyor. A year or two ago, the

Canadian Society of Civil Engineers proposed to allow all surveyors to become members of the Canadian Society of Civil Engineers for the reason I have just stated.

Mr. Willis Chipman:—Mr. President and Gentlemen: I do not know that I can say anything that would be of interest to you to-night on this important matter; a few years ago I was chairman of a committee having the matter in charge for the Canadian Society, to bring it before our Government; and we met with such a reception that I have not felt very enthusiastic over it since. However, it has been revived again this year by the Canadian Society, and we hope by next year that probably we will be able to report progress.

I, for one, am in favor of uniting the two professions. In this new country of ours we cannot afford to have a number of similar professions or societies where one society is enough. There might be different branches or different departments in the one society, as is suggested by Mr. Davis; I hope that the amalgamation of the two societies will be consummated in my day.

Mr. Villiers Sankey:—I thought I had a letter here that would partly answer one of the remarks which Mr. Davis has just made, but I am sorry to say I have not the letter with me; but I can recall the substance of it; and Mr. Van Nostrand can give us the answer that was sent to the letter I refer to.

This letter was from a gentleman in Winnipeg, who suggested that there were a great many examinations, and a great many fees to be paid by surveyors in the Dominion of Canada, and he thought that it would be advisable for us to meet on some intermediate ground, probably not a very high plane, that would be common to all the Provinces of the Dominion, as well as to the Dominion Land Surveyors. His idea was that a man having passed his preliminary examination, and having served a reasonable apprenticeship, should then be permitted to pass a final examination, which would qualify him as a competent surveyor in all the Provinces of Canada. In other words, make us all what the public thinks we are, Dominion Land Surveyors. I have been met with the question, "You are a Dominion Land Surveyor?" and when I have said "Yes," I have then been asked, "Then you can survey from the Atlantic to the Pacific?" My answer to that rather astonished my questioner, when I said, "I cannot." As a matter of fact, the amount of ground a Dominion Land Surveyor has a right to survey is rather re-

stricted; years ago, he could survey in Manitoba, but now he cannot. A Dominion Land Surveyor cannot survey in Ontario or in any of the Provinces. A letter on this question came to Mr. Van Nostrand before I became Secretary of the Association, and he answered it, in the only way he could answer it, showing that down in the Eastern Provinces the qualification for Provincial Land Surveyors is not at all comparable to what it is in Ontario, in Quebec or in Manitoba. Some years ago we were rather astonished to find that the Board of Dominion Land Surveyors would not recognize Ontario Land Surveyors at all; and at a recent examination in Ottawa they asked Ontario Land Surveyors to pass the whole examination.

While speaking of Examiners I am able to say on behalf of the Ontario Land Surveyors that ours is the broadest and the most open-minded Board of Examiners that there is in Canada to-day; under our recent Legislation it rests with the Board of Examiners to say whether the candidate will be required to pass the whole of our examination or part of it, and how much service he will be asked to undergo. We are not bound by any hard and fast rules or by any reciprocity with any other association either Provincial or Dominion. I do not think, to-day, even if the Dominion Board asked our members to pass the whole of their examination, that we would necessarily turn round and ask a Dominion Land Surveyor, to pass the whole of our examination. If we know the class of examination their members have passed and are satisfied with it, we are perfectly free to say, "That is good enough for Ontario!" And I do not think that the Surveyors of the Dominion can really say that we are behind other Surveyors in any point. The difficulty the Surveyors in the whole of the Dominion have in order to meet on a common plane is that some of the others are not quite up to our standard. I think, however, with proper representation, that any difficulties as to the preliminary examination and time of service could be easily over-come.

Speaking on the question of reciprocity with the Engineers, as Mr. Chipman and some others present know, we discussed that about two years ago; and as far as I was able to judge, the feeling of our Association was that if we could meet on a satisfactory plane we were quite willing to give the right hand of fellowship to every Engineer in the Dominion of Canada. The question was, what position were the Ontario Land Surveyors going to occupy in the event of amalgamation. After a great deal of discussion a mutual basis was established, and

I believe the Ontario Land Surveyors did all they could to help the Engineers to get their Bill through the Ontario House. But until the Engineers of Ontario get some status, some recognized position, an amalgamation will be difficult. If they can get their position officially recognized, I think the amalgamation would follow almost at once. The trouble seemed to me to be that the Engineers themselves were not united. They have to meet a great many difficult questions. There are all sorts of Engineers—I am not saying that in any way slightly, but I suppose engineering, like everything else, has in its ranks a number of specialists. Possibly it may be said that some of these gentlemen are Engineers and others are not; but in the event of amalgamation the Ontario Land Surveyors cannot leave any one out if there is any possible way of bringing all together. In engineering we find the Mechanical Engineer, the Railroad Engineer and the Municipal Engineer; and I am glad to say that our Association of Ontario Land Surveyors embraces some representatives of almost all these classes in Ontario. The City Engineers of almost every City of Ontario and the chief Engineers of such Railway Companies as The Canadian Pacific, The Grand Trunk, The Central Ontario and others I might mention are all regular members of this Association.

I think the paper we have just heard read points in the right direction; and we ought to nominate a special committee to try to further the objects brought before us. We are in a position now to do so, having an Association of some years standing, and having some little weight in the community. We have experience in the matter of getting incorporation; and it certainly would not hurt the movement if we were in a position to say, "We have a committee ready to meet you and ready to discuss the whole question."

I hope to hear some other members express their views; I know Mr. VanNostrand has some excellent ideas on the question of amalgamation with the other Surveyors of the Dominion. We need not be afraid of expressing our opinions here for while there are a good many Surveyors and a good many Engineers in the room, we are all here to-day as Ontario Land Surveyors, and the fact that this is a meeting of Ontario Land Surveyors ought not to hinder an Engineer who has strong views from expressing those views. We are not going to take advantage of any remarks that may be made here. As a Surveyor pure and simple I would say the sooner the amalgamation

of Surveyors takes place the better for the Association and the better for the whole profession; and, I believe also, for the public at large.

As Secretary of the Association probably I should not have taken up so much time, but I am afraid some of our members are a little bit shy so I wanted to start the ball rolling. (Applause).

Mr. A. J. VanNostrand (Toronto).—Mr. President: Some years ago I somehow got hold of the idea that it seemed rather foolish to ask a man who had taken the Dominion Topographical Certificate to come here and wade through the "Pons Asinorum" and a few more such things, and I opened a correspondence with the Secretaries of the various Provincial Boards, with a view to arriving at some sort of arrangement under which a man might pass an examination in the elementary subjects at least, before any one Board, and by reason of that examination be admitted by any other Board in the circle. The thing went along very well until I reached British Columbia; and there I got a private hint that their door was wider open than ours was; that, under their Statute, Engineers of various kinds were admitted on short terms of service; in fact persons were permitted to enter the profession of Land Surveying in British Columbia on much easier terms than those required by any other Board! As the Engineers did not seem to be in a position to offer any *quid pro quo* it seemed to me that it was about time to give up my idea and I did so. It still seems to me, however, that theoretically speaking it is not the part of wisdom to require each man to go over the same ground again if he happens to wish to take out certificates from the various Boards, Provincial and Dominion. Such, however, is the position to-day. And until the Engineers arrive at some stated form of examination I do not see how we, Land Surveyors, even supposing all Dominion and Provincial Land Surveyors had amalgamated, could come into association with them.

The Maritime Provinces, however, do not appear to have a standard in any way similar to our own for admission to the profession of Land Surveyor. So far as I can learn, a Land Surveyor there is a good practical man who is about as far advanced as a good timber estimator is here; a man with a little mathematical knowledge, and a little practical knowledge of surveying. And until their standard has been brought nearer to ours it does not seem to me to be a wise thing to amalgamate with those Provinces. As the writer of the paper suggested, all

things are trending towards union because the various Provinces are uniting and the professions of Engineer and Surveyor are kindred to such an extent that they are carried on by the same parties in many instances, and therefore, we ought to make some move. It would be a very good idea to have a committee appointed because if something is to be done this is a very good time to make a commencement. (Applause).

Mr. G. B. Kirkpatrick (Toronto):—Mr. President and gentlemen: When Mr. VanNostrand was speaking I thought of an old story told of the American War, where the standard-bearer planted his standard on top of a hill and in front of his men who called out to him, "Come down! Bring the standard down!" His reply was, "Never! Bring the men up to the standard." I do not think we should come down to a lower level than our own. (Hear, hear). We have been for years bringing our standard up; and we must keep it there. I say, just as that standard-bearer said, Bring your men up to our standard and then there will be no difficulty. I am quite in accord with the idea that it is nonsensical to make Surveyors pass the same examination over again. On that point I think our Board has taken the proper stand, that is, to keep the door open, without lowering our standards and to recognize that we are not the "whole bunch," to speak vulgarly. We have a standard which is second to none, but we are not going to humiliate men who have passed a first class examination in mathematical subjects, by asking them to go in again for a similar examination; we are quite satisfied, if they can present their certificates, to give them the examination. We must, of course ask them what their term of service has been, so that they should not militate against our own men as regards service. We leave them free to take up the higher subjects which we have in our profession the curriculum for which, as you know, has been extended until it embraces almost everything that an ordinary Engineer has to pass.

There are specialists in the different branches of Engineering who occupy positions which it is impossible for the ordinary Engineers to attain to. The Engineers and the Surveyors who have passed within the last ten or fifteen years, are quite able to cope with the majority of engineering or surveying problems which arise in Canada to-day. Mention has been made here to-night of the chief Engineers of different Railway Companies; and as to those gentlemen let me say that they are nearly all self-made men; they did not attend College, they

did not pass examinations, but they had a broad knowledge of what the best Ontario Land Surveyors require and they had good common sense. They did not get into a rut. They studied their profession and they gradually rose by the force of their education and their abilities to be the head men in their respective Companies to-day.

As an example, I remember Mr. Hobson when he was an Ontario Land Surveyor—he is one still; when he was second engineer on construction on the Grand Trunk, on the next section to which I had the honor of being rod-man. Mr. Hobson was then a tolerably young man, and I do not suppose he had studied engineering very much; yet he has solved a problem which I suppose would be an example to the most highly educated. He was the Engineer of the St. Clair Tunnel at Sarnia. I remember when the two borings, one from each side of the River met, that there was not two inches of difference; that was pretty good engineering. There is no reason in the world why all our Surveyors should not work together for the benefit of our profession: and if having amalgamation between the Engineers and Surveyors is going to raise the profession I do not think the Engineers when they are ready for it, will find the Association of Land Surveyors are backward in joining them. When this matter was up before, I remember we made a very good advance; there was a deputation, amongst the members of which I remember Colonel Gzowski and Allan MacDougall, and some other Engineers, and we met them and discussed the subject, and there was no opposition on our part; there never has been. Our desire always was, not to be dragged down and put on a lower level than we stand on to-day. If the Engineers become incorporated, and then approach us in as friendly a spirit as they did before, I see no reason why we should not have amalgamation. (Applause).

President Ross:—I understand the proposition made two years ago by the Civil Engineers was that all Surveyors were entitled to become Civil Engineers; but there was no proposition to make all Engineers Ontario Land Surveyors. Is that correct?

Mr. Sankey:—Yes.

President Ross:—Of course that was very favorable to the Land Surveyors, and very considerate of the Engineers.

Mr. Sankey:—I think you are stating it a little wrongly. It was, All Surveyors at the time of incorporation; not, All future Surveyors.

President Ross:—Yes, I understand that: With regard to the Ontario Land Surveyors becoming Dominion Land Surveyors, I was not aware that it was necessary for an Ontario Land Surveyor to pass the full examination. Of course it was some years ago when I qualified.

Mr. Sankey:—All I can say in answer to that about a week ago several members of our Association went down and passed their examination; and they were required to pass in everything.

Mr. VanNostrand:—Including certain preliminary examinations too.

Mr. Sankey:—They went through the whole academical and theoretical examination as if they were not Surveyors.

President Ross:—That was not required some years ago.

Mr. Sankey:—No.

With regard to Manitoba, they have the reciprocity clause in their Act which provides that they will reciprocate with any other Provincial Association and not require examination in anything but the special Manitoba Land Acts, as I might put it. That is, if the Association from which the Surveyor seeking admission will reciprocate with them. The question has been asked me, and the answer I have had to give is, We have no reciprocity now at all; but if the Manitoba examination is in the opinion of the Examiners sufficiently similar to ours we will not examine at all except on the Ontario Survey of Lands and Drainage Acts; and if their term of service is sufficient we would not ask them service. That seems to be the position we are in to-day. But we could not write to a man and say, We will reciprocate with Manitoba if Manitoba reciprocates with us. If the examination is good enough in Manitoba, reciprocity or no reciprocity, Ontario should say, Your examination is good enough for us; pass the special subjects and we will give you a certificate. Reciprocity does not amount to anything; it is merely a motion of the Board of Examiners for the time being. The Dominion Board a little while ago—(I do not know what happened them)—simply wrote and stated they would not recognize Ontario Land Surveyors in any way; and now they examine our men in everything. Are we going to say to the Dominion if their men come up here, We are going to examine you in everything? I hope not. We know their Examiners are clever men and that they put their candidates through a stiff examination. Then why should we say because

you examine our men, we will examine yours. If we are satisfied with the man's standing it is better not to examine him at all; it costs the Association something every time we examine a man, and it is better to get good men without examination, except in subjects which are absolutely necessary.

H. J. Bowman (Berlin):—My first impression, formed some years ago, was that the Association of Ontario Land Surveyors had the ground work for a combined society of Surveyors and Civil Engineers, and that with a few slight additions to our present legislation we could make room for those that were purely engineers, and had no knowledge of the laws regulating the surveying of lands. And I still think that such would have been a much easier method to pursue than the one that has been followed; for we find that the Canadian Society of Civil Engineers met with considerable difficulty and in fact were not able to carry through the Bill they introduced. However, they are seeking fresh legislation, and, judging from what Mr. Chipman says, they will bring up their Bill again shortly, and we must meet the conditions as they are. My recollection of the Bill as finally amended is that it was in such a shape that it would be acceptable to the Land Surveyors; that there was nothing interfering with the interests of those who have applied themselves more particularly to land surveying and who do not take up civil engineering to any great extent. There seemed to have been two opposing tendencies; those Engineers who thought they were above the Land Surveyors, and those Land Surveyors who were content with their present position and did not wish to endanger the status of our present Association; but it seems to me a course can be pursued where the interests of all may be conserved.

I had hoped that Mr. Chipman would have outlined a little more fully the Bill they are going to bring in shortly. He could not have got a more propitious time to present it to this Association, seeing that it has been proposed to-night by our President, our Secretary and different members here to form a Committee, before the Engineers asked us to work in co-operation with them. This is a move in the right direction.

The engineering profession in Ontario is not in as desirable a position as it should be; we find that public money is being spent in some of the large towns, and in the smaller towns and villages of course, very inadvisedly; large amounts are being spent for what should be permanent improvements but these are executed without any engineering supervision what-

ever. Some practical man who thinks he knows all about it has charge of the work and in a couple of years afterwards the municipality find how little that man really did know, and how ill-fitted he was for his position. It is a very easy matter to design a public work to please the people for the day; but to form any opinion as to what the condition of the work may be fifty years hence is a different matter. My observation has led me to believe that a great deal of the money of the municipalities is being thrown away, and the work will have to be all done over again in a few years, just because of want of proper legislation to protect the public from this waste of their money by bringing up a class of Engineers who are not only competent to do the work, but who will get the work, and who will not be underbid by those who have a political pull, or a pull in the local municipal affairs. (Applause).

Mr. Sankey:—Certain members of the Engineering Profession in Ontario objected very strongly to the Engineers' Bill going through. But in the Province of Ontario at large, outside of professional boundaries there seems to be a growing feeling against what are called "close corporations;" and I suppose the Ontario Land Surveyors are sometimes called a close corporation. But any corporation that tries to give the public a good professional man is not a close corporation. Nevertheless the difficulty that the Engineers, or those of any other profession, are going to meet with before the Local House here is the cry of "close corporation;" and until the bodies asking for incorporation show a united front with the Government they are opening the door through which the Government will get out. Want of unity was really what killed the Engineers' Bill. The Legislature of Ontario to-day does not want to run the risk of being told that they are creating a lot of close corporations all over this Province. They will say, "You are not representing this before us in the interests of the whole of your profession." If the Engineers could come together and present a bill before the House that can be supported by every branch of the Engineering Profession I am perfectly sure the Ontario Land Surveyors, who, as a body have possibly some little weight in the Local House, will put their shoulders to and help them to get their Bill through the House.

Mr. Bowman also spoke about the spending of public moneys. It is perfectly true there must be an enormous amount of public money spent in Ontario to-day that is wasted, thrown

away; and unfortunately the Engineering Profession as a body gets the blame, simply because the public does not discriminate between what Mr. Bowman called the ordinary practical man, and the engineer; and the public says, "Oh, an Engineer did that," and so the Engineering body as a whole gets a bad name.

Mr. Aylesworth:—Mr. President: There are one or two words in Mr. Davis' paper I would like to have eliminated. The writer speaks of money being "squandered on canals and railways." I would suggest that the paper be changed to read "A large amount of money expended." With that change I would move that this paper be received and the thanks of the Association be given to Mr. Davis for it.

Captain Gamble:—I have much pleasure in seconding that motion.

The President put the motion, and, on a vote having been taken, declared it carried.

This Association is not responsible as a body for the opinions expressed in its Papers by Authors.]

SURVEYS FOR MUNICIPALITIES.

BY H. J. BOWMAN, OF BERLIN.

[The following is a summary of the Paper as read by Mr. Bowman, the MSS. having gone astray.]

Those sections relating to municipal surveys form an important part of "The Surveys Act." Particular attention is directed to sections 10 to 13 of the act, relating to boundary lines of townships, and to section 14. In 1897 an important addition was made to this section as follows: (4) On the return of such survey to the Commissioner of Crown Lands he shall cause a notice thereof to be advertised once in each week for four weeks in some newspaper published in the county town of the county in which the lands lie, and shall specify in the advertisement a day not less than ten days from the last publication on which the report of the survey will be considered, and parties affected thereby heard, and on the hearing the commissioner may either confirm the survey or direct such amendments or correction to be made as shall seem just, and shall confirm the survey so amended or corrected, and the lines or parts of the lines so surveyed and marked as aforesaid, shall thereafter be the permanent boundary lines of such concessions or side roads or part of concessions or side roads to all intents and purposes of law whatsoever, and the order of the said commissioner confirming the said survey shall be final, and conclusive upon all parties; and shall not be questioned in any court whatsoever; 60 Vic., Chap. 27, Sec. 14.

Previous to this amendment to the act these municipal surveys had much the same standing as surveys for private individuals, but now, no doubt there will be applications for many more.

Section 15 deals for the first time with angles of lots, and all surveys under this section are to be confirmed in the manner provided in the previous section. The foregoing refers to those portions of "The Surveys Act." known as "Municipal" surveys. It is evident that these sections of the

act apply only where the original survey was made by the Crown, and there is no question but that they will be in the interest of the people at large. Many towns and villages in this province were laid out for private individuals many years ago, and now the street lines are in many cases obliterated. Some means should be provided so that the councils of all municipalities may have resurveys made; also in many towns permanent cement walks and other street improvements are being made without having the street lines properly defined. . The writer would suggest that in all cases the application of the municipal council be to the County Judge who would appoint an Ontario land surveyor to do the work. On the return of the survey the County Judge should cause a notice to be advertised in some newspaper, and specify the day when the report of the survey will be considered, and the parties affected thereby heard, after which the survey, being amended if necessary, would be confirmed. In 1897 an important amendment was made to this section, so that now surveyors must follow the method adopted in making the original survey as shown on the plan of same. This would be filed in the Registry Office, and could easily be produced at the County Judge's chambers should it be necessary when a survey is being confirmed.

DISCUSSION.

Mr. H. J. Bowman:—This opens up a field for discussion; and as I see the next order on the programme is a discussion. I hope the members will state briefly what they think about this proposition for putting our surveys on a little better footing.

Mr. Dickson:—I think the idea of having monuments planted at the corners of streets and so on is a capital one. You have all no doubt had practice in village and town surveys. I know in my town the first thing I have to do is to establish the intersection of streets, and in many places there has only been a bit of a post, perhaps two inches square, put down and no lot number on it; such posts last only for two or three years, and then they are gone. I think it should be compulsory for the municipalities and the owners of land to plant permanent monuments in new surveys, and also for municipalities, towns and villages, to put an iron post of about an inch and a half or two inches in diameter, say, three feet long, at the intersection of streets already laid

out, leaving six inches or a foot above the ground, with the name of the street stamped on the side next to the street, and the number of the lot on the other side. They do so in Manitoba.

Mr. Sewell:—I think while discussing this subject it would be well if our Committee on Legislation would look into the wording of those municipal sections under which we work. I am speaking from personal experience. I know that the sections only call for a very limited amount, now, for instance, if you wanted to lay out a block of two or three Concessions, where the posts were pretty nearly lost, you cannot do it under the Municipal Act, it is not provided for. You can run along one concession, but you cannot turn round the corner and go down, that is prohibited; if you do, the Surveyor is going to be left in the lurch, as I was on one occasion, to the tune of about \$200.

President Ross:—Did you carry out your instructions?

Mr. Sewell:—I carried out my instructions from the Crown Lands Department. It was in the Township of Papoonge, where I surveyed a large block; I got \$500 from the Crown Lands Department, and the rest I was to get from the Municipality. I found out afterwards that the whole transaction was illegal.

President Ross:—The parties who gave you the order were responsible.

Mr. Sewell:—But it couldn't be assessed. There was no law for assessing it—it couldn't legally have been assessed. There is a clause in that Act that provides for the assessment for the payment.

Mr. Aylesworth:—In the early part of the paper the writer says there is no machinery for confirming municipal surveys.

Mr. H. J. Bowman:—Made for a County Council.

Mr. Aylesworth:—The instruction comes from the Commissioner of Crown Lands; and the report is made to his Department, and the survey is approved by him, and payment made to the Surveyor; isn't that a confirmation of it?

Mr. H. J. Bowman:—There is no method given in the Act for confirming surveys made for County Councils; but there is a method laid down for confirming those made for Township Councils.

Mr. Aylesworth:—Bench marks may be put down, but before that is done instructions have to come from the court, and the report should be made to the Crown Lands Department. When

that report is made, and approved, and payment made, is not the survey confirmed as to the courses and distances and so-forth?

Mr. H. J. Bowman:—I wish we had some of our standbys—Mr. Gibson or Mr. Kirkpatrick—here in discussing the Act, but I think every member knows until this amendment of 1897 there was nothing in the Act that prevented municipal surveys of any kind from being reviewed by the courts, and, if there was any later evidence, the whole thing could be set aside. In 1897 a subsection was added:—

Mr. Aylesworth:—But it did not cover the former sections.

Mr. H. J. Bowman:—A subsection was added to section 14 which deals with surveys for Township Councils; and I think it is very plain now that the courts hold no jurisdiction to take up and set aside a survey of that kind. The subsection says it shall not be questioned in any court whatever. Now, the intention of the Legislature is that those surveys made by the instructions of the Commissioner of the Crown shall be final; even should there be some evidence later on to show that there might be a difference of opinion. But that method of confirmation is not attached to the previous clauses where surveys of boundaries have been made. It does not apply to them. If it is a good thing why should it not be made to apply to those. I do not suppose there are many surveys of that kind made, but there might be.—

Mr. Aylesworth:—Some years ago I remember a case of a survey in the Township of Hinchinbrook and the Surveyor making his verification failed to get some original posts; afterwards I found those posts, got evidence, went into court and upset his survey altogether as far as those lots were concerned.

Mr. H. J. Bowman:—By advertising in the newspapers opportunity would be given to the parties interested or who owned the lots to come forward with their evidence; and if they did not appear either personally or by counsel before the Commissioner of Crown Lands the survey would then be final and would be confirmed, and later evidence would not be received and so they would be the losers. It has to be advertised in the County Town. Some county towns have not a newspaper—at least one county town. This might occasion a difficulty such as that experienced by my friend Mr. Sewell; and when the Act is being revised again, as it is periodically, it might be amended to read, the County Town or some other town in the County.

Mr. Aylesworth:—The paper is a valuable one and I move

it be received and adopted and printed; I would like to have it referred to the Committee on Legislation so that they might take up the suggestions and if possible have them carried out.

Mr. H. H. Gibson:—Is it the intention of this paper to make it compulsory to have surveys made or make a similar survey as provided for township surveys?

Mr. H. J. Bowman:—Now, the Act only applies to surveys made for the Crown or those that have the same effect—original surveys. We know, for instance on the line of the Grand Trunk West, that towns were laid out at the time the railway was building and large subdivisions of three or four hundred acres were made, and at present there is no way by which a re-survey can be made at the expense of a Municipal Council, and monuments planted, and an advertisement put in the newspaper, and people given an opportunity to come forward and bring in evidence; there is no means of doing so in these towns. The Act simply applies to those towns where the original survey was made for the Crown, or for the Canada Company, or for some other company or individual that had the grant direct from the Crown of a large tract. There is no way of having an ordinary subdivision re-surveyed and put in such shape that the matter will not be questioned by the courts.

Mr. Sewell:—The only way to do it is to file the affidavits.

Mr. H. J. Bowman:—That does not do any good; the matter can be brought up in court again. To make a particular case, in my town (Berlin) there was a large survey made of some three or four or five hundred acres along the Grand Trunk; this survey was made at the time the Grand Trunk was built, and there were no stone monuments planted in that survey; it was made fifty years ago, and now, the old fences are gradually disappearing. There are no cows running at large in the town, so that people do not feel like putting up fences in every case, because fences cost quite a bit of money, and they are rather unsightly sometimes, so that as the fences decay they simply have them removed and have the fence line marked perhaps by some little cedar hedge or something of that kind—or perhaps not at all. You will find very few places on that survey where the street lines can be got at by any monuments whatever. There was a case in court recently, held before the County Judge, and he dismissed the action because there was no evidence to show where the street line was. The action was a matter of trespass; and the Judge said, "You could not prove where the line was." As time goes on

this will become worse. If a survey were now made at the expense of the municipality to put stone monuments at the intersections of the streets, some evidence can still be had. The old residences and the old fences, if left standing, are mute evidence of the approximate location of the street lines, and a resurvey could be made and advertised; and that would be much better than if the matter were deferred to later on. I think the Act ought to be extended to apply to all the municipalities; it is a good thing to apply it to all.

Mr. H. H. Gibson:—I quite agree with Mr. Bowman on this subject, that this law should be extended to villages and towns, and even cities, for we meet with a great many difficulties in locating the angles of streets and lots, and in many cases it would be impossible to locate the original ones. I have a good deal of this work to do myself. At the present time I am making plans for two villages; I have been making them for three years. I am always guided by the Registrar's wish to hurry the matter or let it stand; and in the present case he did not want me to hurry it. In one of these villages boundaries are very easily located—in the other one, which was a very old village, it was almost impossible to find the boundaries at all along certain streets; it was built on a marsh, with a main road up through the village, where they had laid the logs over the swamp, leading to the mills; and I had to establish that road as well as I could, to put it on my plan.

The Registrar in the north part of the County of York has adopted rather a peculiar method in reference to registering plans of villages; he wishes me to show upon this plan any lots that are not shown on the registered plan, and give those lots special numbers, commencing at No. 1, and going up as high as they run—there would be perhaps 150 lots on the total plan; and he registers these lots the same as an ordinary registered plan; and any deeds registered after that, have to refer to that plan, as No. so and so, and the plan has the same authority as a registered plan by an individual, in his opinion. I would like to hear some opinions on this matter, if it does not interfere with the discussion on Mr. Bowman's paper.

President Ross:—In Welland County the Registrar requires all lots not laid down on a registered plan to be designated by some letter or number; and they have all to be designated by that letter or number in every transfer afterwards; and he claims that he does that with the approval of the Inspector of Registry Offices. Of course unless lots are so designated, the value of a compiled plan is not nearly so great as it should be.

With regard to the setting of stone monuments, there is no authority now. When a Surveyor undertakes to make a corporation plan, if he indicates the angles of the corporation, he thinks he is doing a very good thing, but in a great many towns and villages they do not know even where the angles of their corporation are. After a time they forget even when they were incorporated, or by what authority they became incorporated, and forget where their actual boundaries are. Heavy substantial stone monuments could not be easily removed or thrown away, and they should be set at the intersection of important streets or roads in all municipalities.

Mr. H. H. Gibson:—Where would you place these monuments?

President Ross:—In a convenient place, indicating their position by offsets which could be shown on the plan. Every difficulty as to position could be easily overcome.

Mr. H. H. Gibson:—It is impossible to put them at the corner of the lot in many cases, for instance where there are large buildings.

President Ross:—A Surveyor going out to make a survey in many places may spend much time, and though he may make a correct survey, if he goes into court, it would be hard to prove that his work is correct, because so many things have of necessity to be supposed, and most surveys that are made become matters of evidence. While you might call it a legal survey in one way, it would be impossible to say that it is actually correct according to the original surveys, or monuments planted in the original surveys. If advantage were taken of this Act, there is no doubt it would be a very good thing for the people, and probably for the Surveyors too.

Mr. Davis:—I had some experience a few years ago on the first question Mr. Gibson raised; I was called upon to make a re-survey of five villages in one township; and the plans I made were filed in the Registry Office, and I believe they have superseded the old plans largely. The lots were all renumbered; letters were used for the blocks, and figures for the numbers of the lots. I think there was a great weakness however in the survey, from the fact that no monuments were planted, and the lot corners are not established any more to-day than they were before that survey, and trouble may arise in the future, just as in the past, in reference to the subdivisions. In fact, I have since been called upon to locate a special lot in one of those villages, and in order

to locate it definitely, one of the old residents was brought forth who knew of a place between the lots, on the borders of the road, where Mr. A. B. Pary, many years ago, planted a post; and we spent a forenoon in digging all along that street, and finally found this cedar post which no doubt established that corner; and our survey was made accordingly. I fully concur with Mr. Bowman in his ideas regarding this subject. Where these surveys are made, whether Township boundaries or Concession boundaries, or town lot boundaries, a stone monument or an iron monument of some kind should be planted. With regard to the buildings standing in the way of a corner in a town or city, the plan adopted in Winnipeg, that I noticed on the general plan there of the city, and which perhaps is adopted here and elsewhere, of laying down a line at a certain number of feet, say six or ten feet, from the corner of the block upon which all those iron monuments have been planted, and stamped as suggested by Mr. Dickson, would be useful. While it is not the actual corner, it designates the corner as being a certain number of feet in from this established line, so that it becomes an easy matter at any time in that city to locate any corner of a block.

Mr. Dickson:—Is that the case in all streets, or only where buildings are in the way?

Mr. Davis:—I believe that prevails all through the City of Winnipeg; a red line is laid down on the plan parallel with the road and six or ten feet from the corner.

President Ross:—The City Surveyor's plan.

Mr. Davis:—Yes.

The President:—It would have no legal standing; it would be only a private reference. . . .

Mr. Davis:—I do not suppose it would have any legal standing; but there is no reason why it could not have authority in all the plans that are registered.

Mr. Arthur Harvey:—Mr. President, I beg to present you with a couple of pamphlets bearing on the metric system, which is a subject I have been led to take some interest in lately, and I thought it would be a matter for discussion at this Convention.

President Ross:—Thank you. We had a slight discussion on that subject a few minutes ago; we are very pleased to get the information. Have you anything further to offer the meeting?

Mr. Harvey:—I have nothing to offer. I will be glad if the

Society will express its opinion as to the matters to which I have alluded in the communications I have given you.

Mr. Warren:—I think Mr. Bowman's paper is very interesting, and a very important paper. Those of us especially who have been long in practice would know these corners and places, where perhaps some of our younger Surveyors would not. I know in villages in the County of Halton it has been in some cases very difficult to locate these points; but if stone monuments or permanent monuments had been placed years ago, they could have been much more readily established and found; I know in the Village of Georgetown a stone had been planted by Mr. Joseph Black, an old Surveyor, as marking an important corner of a street, but the owner built a stone house at the corner, and instead of leaving that stone monument, or putting a permanent one, he carefully carried away the stone, and he has it upstairs in his house so that it can be looked at there. I was looking for that stone in making a survey; and he told me that he had it upstairs in his house. It might as well have been in Botany Bay. I think we should ask that the suggestions in this paper be enforced now, while many of these places could be established that possibly we may not be able to establish later on. I know cases in Georgetown, and in other villages in the County of Halton, of posts being found by digging down in the neighborhood where either a fence post or the corner post of the lot had been. Another difficulty arises from the fact that the Surveyors' chains were not tested to the millionth part of an inch, as they are in the Standard now, for sometimes the chain was a link long; I know in that county, taking all the lots, the chain must have been fully a link long, because every lot measures about thirty chains and thirty links. It is very difficult now to make up a division of lots by actual measurement. The Surveyor might have surveyed one part of the village, and his chain was so and so, and the longer he went, the longer his chain went. It should not only be in towns, but in villages, cities and townships that the corners ought to be established permanently. In many of the newer townships those corners can be established, but in the older ones it would be almost impossible to do it, except by the old fence posts, and they cannot always be found. I approve very much of the paper, and I hope it may be acted on.

Mr. Sewell:—Sometimes in measuring over the same piece of ground with the same tape, I have found the distance between these posts considerably shortened when the ground was cleaned.

President Ross:—It makes a difference who measures it, and what state the ground is in

Mr. Sewell:—Where I measured myself over the same ground, I found a difference after the ground had been cleaned up, from what it was in the bush.

Mr. Bowman:—One remark, before closing. There seems to be an opinion on the part of some of the members that there should be legislation compelling the municipalities to have particular lines defined. I think we ought to go rather slow in that direction, and that the first thing is to get machinery by which they may have their street intersections defined. I think it would be a very good idea to have this matter referred to the Legislation Committee, and then we might get legislation that would make it possible to have it completed. The matter might be brought to the attention of Municipal Councils. A circular might be issued by the Association.

President Ross:—This Committee might take steps—

Mr. Bowman:—Yes; pointing out to the Municipal Councils the desirability and economy of having it done now, of having their street intersections marked by planting monuments, and having a small appropriation made in their estimates for doing so, because a dollar spent now will save ten dollars or more to their rate payers later on. I think if we brought the matter to their attention that a good many municipalities would have it done. We should not try to force them to have it done; we need not do that.

President Ross:—We cannot do it.

Mr. Dickson:—I think it would be well to have it compulsory on any person sub-dividing lands in the future to have the corners and intersections of streets so identified. An iron post an inch and a half or two inches in diameter will cost very little.

President Ross:—An iron post could be taken up and thrown away.

Mr. Dickson:—Yes, or a stone could be thrown away; but it would cost much more and be harder to plant.

Mr. H. H. Gibson:—Around Toronto they use our wooden stakes for kindling-wood; as fast as you plant them they are taken up and used.

President Ross:—I suppose you do not usually plant anything, but make a plan.

Mr. H. H. Gibson:—We make the plan.

PAPERS USED AT THE FEBRUARY SESSION OF THE BOARD OF EXAMINERS, 1901.

PRELIMINARY EXAMINATION.

SUBJECTS NOS. 1 AND 2.

PENMANSHIP AND GRAMMAR.

1. What is grammar? What is a sentence? Into what parts are sentences divided, and how are they classified? Give examples of each, and divide them.

2. Define inflection, and give examples explaining them.

3. What are pronouns? How many classes are there? Give examples and explain.

4. What part of a sentence depends on the verb? How many moods are there? Classify the tenses. Give examples.

5. Fill in the blanks in the following:

I did that lest he —— suspect my object.

He promised that it —— not occur again.

Distinguish the following: You will (shall) have another chance.

If that was (were) the case, what ought I to do?

6. Explain generally the rules of punctuation, and when should capital letters be used?

PENMANSHIP.

Write neatly and carefully letters on the following subjects, giving proper headings and endings:

To the Commissioner of Crown Lands for Ontario, asking for information as to how an application for a mining grant is to be made.

To a sister, giving an account of your visit to a town.

ARITHMETIC.

SUBJECT No. 3.

1. Express the following as mixed or whole numbers,

$$\frac{231750}{153} \quad \frac{14264}{239} \quad \frac{25713}{1168}$$

Reduce the following to improper fractions.

$$26 \frac{201}{202}, \quad 164 \frac{118}{221}, \quad 157 \frac{122}{137}$$

2. Reduce to decimals:

$$\frac{1}{2} + \frac{1}{5} - \frac{1}{8}; \quad \frac{47 \frac{5}{8}}{94} \text{ of } \frac{11 \frac{3}{4}}{7.5}$$

Reduce to circulating decimals:

$$\frac{3231}{3220}, \quad 7 \frac{962}{3367}, \quad \frac{17}{99000}$$

Find the vulgar fractions equivalent to the following,

$$.00185, \quad 3.024, \quad .01236$$

Give the rule for the latter and explain it.

3. If a man walk 62 miles in 3 days, in how many will he walk 80 miles?

How many men must be employed to finish a piece of work in 15 days, which 5 men can do in 24 days?

A church clock is set at 12 on Saturday night, at noon on Tuesday it is 3 minutes fast. What will be the time when the clock strikes 4 on Thursday afternoon?

4. Define square and cube root. Extract the square roots of

$$98596, \quad 37249, \quad 11664$$

$$\frac{3}{8}, \quad \frac{1}{17}, \quad 2\frac{1}{2}, \quad \frac{3\frac{1}{2}}{4\frac{1}{2}} \text{ to 4 Places.}$$

Find the cube roots of 54872, 110592, 300763.

5. Three townships have to raise among them \$7,450, each in proportion to its assessment, which is \$1,745,680; \$2,385,000, and \$4,763,540; find to the nearest cent the proportions?

6. If a cubic foot of water equal 25 quarts, how many gallons will pass under a bridge every 10 minutes; the stream is 23 feet

8 inches wide, average depth 3 feet 6 inches, rate $3\frac{1}{2}$ miles per hour.

7. Find the values of 1,270 boards $15' \times 13'' \times 1\frac{1}{4}''$ at \$18.50 per M. 1,750 scantlings $16' \times 7'' \times 3\frac{1}{2}''$, at \$23.75 per M. A pile of cordwood $5\frac{1}{2}' \times 26\frac{1}{2}'$, at \$3.75 per cord.

8. A merchant sold 4000 yds., of cotton at $7\frac{1}{2}$ cents per yard. What should he remit his principal, his commission being $1\frac{3}{4}$ per cent. and expenses amounting to \$45.60?

(A) LOGARITHMS, AND (B) ALGEBRA.

SUBJECT No. 4.

(A).

1. (a) What is the Logarithm of a number ?

(b) How many kinds are there in use, and what is the base of each ?

(c) Explain each part of a Logarithm, and give the name of each part.

(d) What operations of calculation can be performed by the use of Logarithms ?

2. Find the Logarithms of the following numbers; (a) 1; (b) 10; (c) 100; (d) .0002507; (e) 23764; and (f) 237.64.

3. Find the numbers corresponding to the following Logarithms, (a) .812913; (b) 2.524656; and (c) $\bar{1}.276692$.

4. Calculate the value of $\sqrt[5]{\frac{1}{249}} + \sqrt[5]{\frac{23}{11}}$

5. Multiply together the following by using Logarithms: 1728; .00024; .7462; 302.1 and 7.6094.

(B).

6. (a) Explain the difference between an exponent and a coefficient, and how are each treated in Multiplication and Division ?

(b) What is the law of signs in Multiplication ?

7. Remove the symbols of aggregation from the following:

(a) $2a - \{3b + [4c - 4a - (2a + 2b)] + [3a - \overline{b + c}]\}$

(b) $7a - \{3a - [(2a - 5a) + 6a]\}$

(c) $a - \{2b + [3c - 3a - (a + b)] + [2a - (b + c)]\}$

8. Divide by Horner's method:

$$6x^7 - x^6 - 11x^5 + 16x^4 + x^3 + 8x^2 - 19x + 20 \text{ by } 2x^3 + x^2 - 3x + 4$$

9. Factor (a) $x^8y^2 - 64x^2y^2$.

(b) $a^2 - b^2 + c^2 - 1 - 2a + 2bc$.

(c) $1 - 16a^2 + 8ac - c^2$.

10. A man has two horses and a saddle. The saddle is worth \$10, and if it be put on the first horse his value with the saddle becomes double that of the second; but if the saddle be put on the second horse his value with it will not amount to that of the first horse by \$13. Find the value of each horse.

EUCLID.

SUBJECT No. 5.

1.(a) The greater side of a triangle has the greater angle opposite to it. I. 18.

(b) Prove I. 18 by producing a side.

2. ABC is a triangle with AC greater than AB . From AC cut off AD equal to AB . Produce AB to E , making AE equal AC . Join BD and EC . Prove that the angle DBC is equal to the angle BCE .

3. (a) If a straight line be divided externally into any two segments, the square on the straight line is equal to the squares on the two segments diminished by twice the rectangle contained by the segments.

(b) AB is a straight line, with its centre C . D is a point of unequal internal section; E is a point of external section: enunciate or give by numbers the propositions based upon these sections.

(c) Deduce algebraically II. 7 from II. 4.

4. Solve any one of the following deductions:

(a) In any triangle if a perpendicular be dropped from the vertex on the base, the difference of the squares on the sides is equal to the difference of the squares on the segments of the base.

(b) Find the point in the base of a triangle from which lines drawn parallel to the sides to meet them are equal.

(c) If A be the vertex of an isosceles triangle ABC , and CD be a perpendicular to AB . Prove that the sum of the squares on the sides of the triangle is equal to the sum of the square on BD , twice the square on AD , and three times the square on CD .

5. (a) In every triangle, the square on the side opposite an acute angle is equal to the sum of the squares on the other two sides diminished by twice the rectangle contained by either of those sides and the projection on it of the other side.

(b) State the relation of the square on the side of a triangle to the sum of the squares on the other two sides as the angle contained by these sides is acute, right or obtuse.

6 What is the purpose of Book II ? of Book III ?

7. From any point in the base of a right angled triangle a line is drawn at right-angles to the hypotenuse; prove that these lines are divided into segments whose rectangles differ by the square on the line so drawn.

8. (a) If two circles touch one another, internally at any point, the straight line which joins their centres, being produced, shall pass through that point (III 11).

(b) Two circles touch internally at a point, and through that point a straight line is drawn to cut the circumferences of the two circles. If the points of intersection be joined with the respective centres, the two straight lines will be parallel.

9. (a) Angles in the same segment of a circle are equal. Conversely: If two equal angles stand on the same arc, and the vertex of one of them be on the conjugate arc, the vertex of the other will also be on it (III. 21).

(b) If triangles having equal vertical angles stand on the same base, find the locus of their vertices. Show whether the angles at the base change their relations to each other.

10. (a) About a given circle describe a triangle, equiangular to a given triangle. (IV. 3).

(b) Compare as to length the sides of an equilateral triangle inscribed in a circle with one described about it.

PLANE TRIGONOMETRY AND RULES FOR SPHERICAL.

SUBJECT No. 6.

1. Draw a figure showing by lines the trigonometrical functions of an arc, and give the definitions.

2. Show that the unit of circular measure is equal to $57^{\circ}.2958$ nearly. Reduce the angle 60 degrees to circular measure.

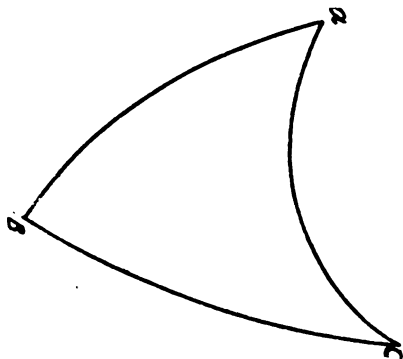
3. Give rules for solving plane right angled triangles. The four cases of right angled triangles. Give proofs of rules.

4. In surveying a Base Line in the District of Algoma, I find it necessary to calculate the distance AC . I measure the lines AB , BC , and angle B . $AB = 5.62$ chains; $BC = 3.20$ chains. Angle $B = 128^{\circ} 4'$. Find length of AC ?



5. Give Napier's rules for solving right angled spherical triangles.

6. In the spherical triangle ABC , right angled at B , the hypotenuse AC is 64 degrees, and the angle C 46 degrees. What are the remaining parts?



SUBJECT No. 7.

MENSURATION OF SUPERFICIES.

1. Find the area of a field bounded as follows: N. $34^{\circ} 15'$, E. 2 chs. 75 lks., N. 85° , E. 1 ch. 28 lks., S. $56^{\circ} 45'$, E. 2 chs. 20 lks., S. $34^{\circ} 15'$, W. 3 chs. 53 lks., N. $56^{\circ} 30'$, W. 3 chs. 20 lks. Give the area in acres, roods and perches.
2. The area of a rectangular field is $7\frac{1}{2}$ acres, and the length of the diagonal is 50 perches. Required the sides in perches.
3. Find the area of a field one side of it being 198 links and seven ordinates to it measured at equal distances to the opposite curvilinear boundary being in order equal 60, 75, 80, 82, 76, 63 and 50 links.
4. State the rule for finding the area of a quadrilateral when the four sides and inclination of the diagonal are given.

SUBJECT No. 8.

LINEAR DRAWING.

1. Draw a perpendicular to a straight line when the point is nearly over the end of the line.
2. Construct an equilateral triangle, the vertical height being two inches.
3. Draw a rectangle having its sides $1\frac{1}{2}$ inches and $\frac{3}{4}$ inch respectively, and construct a square of equal area.
4. Draw two circles of one inch and half inch radius respectively, the centres being three inches apart. Draw two tangents to the two circles.
5. Draw a scale of inches six inches long, divide the first division into ten minor divisions, number the divisions properly, and print over it "Scale of inches."
6. Draw six lines, four inches long—No. 1, very fine; No. 2 medium; No. 3 fine dotted; No. 4 chain dotted; No. 5 heavy dotted; No. 6 heavy.

SUBJECT No. 9.

CANADIAN AND GENERAL GEOGRAPHY.

1. Trace either by description or diagram, the main mercantile waterway of the Dominion, giving names of different parts, and principal towns on same.
 2. Name the British possessions at present date.
 3. State the principal Rivers and Mountain ranges of the world, and give names of the Countries in which they are situated.
 4. Over what oceans would it be necessary to pass, to circumnavigate the world. Name the principal groups of Islands in them.
 5. Give the names of the Capitals of the principal countries of Europe and Asia.
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SUBJECT No. 10.

CANADIAN HISTORY.

1. Give names of the principal explorers of Canada during the French regime, and points of discovery of same.
2. Give names and location of the principal Indian tribes of Canada at the time of the British occupation.
3. Give dates and principal battles of the Wars in Canada with the United States.
4. State concisely the circumstances that led up to the establishment of "Responsible Government" in Canada.
5. At what date did Confederation take place, and what was the form of Government established by the British North America Act?

FINAL EXAMINATION.

SUBJECT No. 1.

GEOMETRY.

1. Book I, Prop. 43. The complements of the parallelogram, which are about the diameter of any parallelogram, are equal to one another.

2. On a given line describe a square of which the line shall be the diagonal.

3. If two sides of a triangle be produced, the lines, which bisect the two exterior angles and the third interior angle, meet all in one point.

4. Book II, Prop. 5. If a straight line be divided into two equal parts, and also into two unequal parts, the rectangle contained by the unequal parts, together with the square of the line between the points of section, is equal to the square of half the line.

5. Book III, Prop. 36. If from any point without a circle two straight lines be drawn, one of which cuts the circle and the other touches it, the rectangle, contained by the whole line which cuts the circle and the part of it without the circle, shall be equal to the square of the line which touches it.

6. Given the area and hypotenuse of a right angled triangle; construct it?

7. Book IV, Prop. 9. To describe a circle about a given square.

8. Book VI, Prop. 8. In a right angled triangle, if a perpendicular be drawn from the right angle to the base, the triangles on each side of it are similar to the whole triangle and to one another.

9. Book VI, Prop. 30. To cut a given straight line in Extreme and Mean ratio.

10. Define "Homologous," "Ex Equali," "Analogy," "Ratio," "Proportionals."

SUBJECT No. 2.

ALGEBRA.

1. Simplify:

$$(a) \frac{\frac{1}{1-x} - \frac{1}{1+x}}{\frac{1}{1-x} + \frac{1}{1+x}}$$

$$(b) \frac{\frac{a^2}{b^3} + \frac{1}{a}}{\frac{a}{b^2} - \frac{a-b}{ab}}$$

$$(c) \frac{1}{x + \frac{1}{1 + \frac{x+1}{3-x}}}$$

2. Prove that any ratio is made more nearly equal to unity by adding the same number to each of its terms.

3. What is the

- (a) Arithmetical ratio of $x^4 - 1$ to $x + 1$.
 (b) the Geometrical ratio of the same.

4. A man performed a journey of 48 miles in a certain number of hours but if he had travelled 4 miles more each hour he would have performed the journey in 6 hours less time. What was his rate per hour?

5. Solve:

$$\sqrt{x^2 - a^2 - b^2} + \sqrt{x^2 - b^2 - c^2} - \sqrt{x^2 - c^2 - a^2} = x$$

6. Define:

(a) Arithmetical Progression; Geometrical Progression; Harmonical Progression.

(b) Insert 5 Harmonic means between 1 and 7.

7. Find two numbers whose sum is nine times their difference and whose product diminished by the greater number is equal to twelve times the greater number divided by the less.

8. (a) Find the greatest term in the expansion of $(a + b)^{20}$ when $a = 2$ and $b = 3$.

8. (b) Find the value of the greatest term in the following:
 $(a - b)^{2r}$.

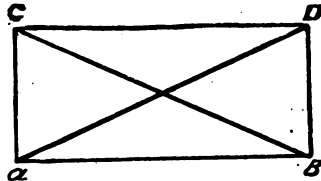
when $a = 2$, $b = 3$, $r = 4$.

SUBJECT No. 3.

TRIGONOMETRY (PLANE AND SPHERICAL).

1. Give the rules and prove the same for solving plane triangles. (a). Given one side and two angles, each adjacent to given side. (b). Given one side and two angles, one adjacent and the other opposite, to given side. (c). Given two sides and included angle.

2.



$AB = 1000$ yds. Angles $BAC = 76^\circ 30'$, $BAD = 44^\circ 10'$, $ABD = 81^\circ 12'$, $ABC = 46^\circ 5'$. Find distance CD .

3. Give Napier's rules for the circular parts for solving spherical triangles, with proofs for same.

4. In the spherical triangle ABC , right angled at B , the hypotenuse $AC = 64$ degrees, the angle $C = 46$ degrees. What are the remaining parts?

5. What is spherical excess and what useful purpose may it be made to serve.

6. What is a quadrantal spherical triangle and how are they solved?

7. Show that the unit of circular measure is equal to $57^{\circ}.2958$ nearly.

Reduce the angle 60° to circular measure.

SUBJECT No. 4.

MENSURATION AND LAYING OUT LAND.

1. Give the method of finding the area of any irregular polygon.

2. State rule to find area of a quadrilateral, when the four sides and inclination of the diagonals are given.

3. Find the length of an arc of a circle whose diameter is 125 and number of degrees in the arc $54^{\circ} 36''$.

4. Prove rule for dividing a triangular piece of land into two parts having a given ratio to each other, by a line through a given point within the boundaries.

5. Find the area of field, one side of it being 198 links and seven ordinates to it measured at equal distances to the opposite curvilinear boundary being in order, equal 60, 75, 80, 82, 76, 63 and 50 links.

6. Find the number of acres in a quadrilateral field whose diagonals are 30 and 40, and the contained angle 60° .

SUBJECT No. 5.

RE DESCRIPTIONS OF LANDS.

1. (a) Give a definition of the word "description," as used in a technical sense by O. L. Surveyors.

(b) When is a description complete in itself? Write one.

(c) When is a description incomplete? Write one.

(d) Give example of wrong description by referring to defective points that may occur.

(e) Give a list of the different kinds of descriptions of lands in various forms which may occur in practice.

2. Lot 35 in Concession A, single front, in Township Block is the last lot in the Concession, the town line being along the north side. The Patent from the Crown describes the lot as 200 acres and sides 100 chains and ends 20 chains each, on Survey Lot found to be north side 105 c, south side 101 c, west end 22 c., east end 25 c. In said Patent courses of sides said to be N 74° E, and ends N 9° W.

(a) A description is required of the east and west halves, each, giving the dimensions in detail.

(b) Also a description of the north-east quarter in detail. tail.

(c) Also a description of a school lot of two acres on the north-west corner, with frontage on west end of two chains.

(d) Also a description in detail of the westerly 100 acres.

(e) Show by sketch the south-east quarter of the south-east quarter of the north-west quarter of said lot.

In all above cases show sketch with description, and calculations may be made approximate.

3. Lot 10, Concession A, single front, Township Block, is 100 c by 20 c, and sides N 74° E, and ends N 16° W.

(a) Required a description of a road to be laid out across the lot, the centre line of which commences at the south-west angle of the lot, and ends at the north-east angle of the west half of the lot, road to be 1 chain wide; make description in detail, with sketch.

(b) Give a description of the east half of said lot with a right of way over the west half of said lot, 50 links wide along the south side of west half. Show by sketch also a description to be in detail.

(c) Write a description of the north-easterly half of the lot as cut off by a diagonal line from north-west corner to south-east corner; description to be in detail.

4. (a) Mr. White owns lot 20, plan 1,000, part of township lot 35, Concession 1, Township H; the lot is $50' \times 150'$, front N 16° W and sides N 74° E. He has a double house built on the lot; the party or middle wall is, or is supposed to be, on the south limit of the N half of the lot. He wants a description to cover the north half of the lot, but to include the north semi-detached house. House $10'$ from front, and $60'$ deep, and each $20'$ wide.

(b) Write also a description of the south half of said lot, considering it not built upon. Description to be in detail.

5. (a) A man owns lot 10, Concession 1, Township A, $20 \text{ c} \times 100 \text{ c}$, 200 acres; saw-mill on west half and pond floods part of east half. Sells west half, and is to give right to flood east half to working head of pond, and right of way 50 links wide along south side east half. Required a description for Deed. Bearings, front of lot N 16° W, and sides N 74° E.

(b) Also write a description for the remaining part of the east half of said lot.

SUBJECT No. 7.

LAYING OUT CURVES.

1. Explain the method of laying out a curve by deflection angles, and prove the ratio of the angle of deflection to the angle at centre.

2. Illustrate method of passing an obstacle, such as a large building, in laying out a curve.

3. What is a compound, and what a reverse curve? Give diagrams of each.

4. Given deflection angle, between tangents $48^{\circ} 16''$ and radius 112 feet, find other angles and distances necessary to lay out the curve.

SUBJECT No. 8.

ASTRONOMY.

1. Define Horizon, Zenith, Nadir, Parallax, Refraction. Explain fully the effects of the latter two in astronomical work.

2. Find the altitude and azimuth of Ursa Majoris (Declination $62^{\circ} 33' N.$) to an observer at latitude $39^{\circ} 57' N.$ when the hour angle of the star is 5h. 17m. 40s. E.

3. At a place in latitude $25^{\circ} 40' N.$, the sun's correct central altitude was found to be $10^{\circ} 6' 27''$, when his declination was $8^{\circ} 5' 56'' S.$, what was his distance from the meridian?

4. At a place in latitude $42^{\circ} 34' N.$, nearly the altitude of Aldebaran (Declination $16^{\circ} 12' 26'' N.$), was found by observation to be $39^{\circ} 2' 10''$, when its hour angle was 3h. 25m. 40s, what was the latitude of the place?

5. The altitude of the pole star being found $39^{\circ} 1' 39''$, the hour angle 5h. 36m. 41s. from the upper culmination, and the polar distance $1^{\circ} 28' 7.68''$, required the latitude of the place.

6. On the 1st of January, 1852, the sun's right ascension was 18 hours, 44m., 49.47s., and his declination $23^{\circ} 3' 28'' S.$,—required his longitude.

7. Give a full description of the precautions necessary to be observed in astronomical observations in order to insure accuracy.

8. Explain fully the cause of day and night and the changes of the seasons, and why it is hot in summer and cold in winter in this latitude, and what effect (if any), would a change in the obliquity of the ecliptic have upon the climate.

SUBJECT No. 9.

RE SURVEY ACT.

1. (a) Describe the different kinds of original surveys by Government.

(b) Describe the different kinds of original surveys by private persons and Corporations.

(c) Describe municipal surveys, different kinds and under what precedent do they take the place of original surveys.

(d) What plans, notes and affidavits are received as evidence in Courts ?

2. (a) How are lines between lots run in single front concessions ? Give the different cases which might occur.

(b) How are lines between lots run in double front concessions ? Give the different cases which might occur.

(c) How are lines between lots run in sectional concessions, *i.e.*, where run out in blocks as per Order-in-Council, 27th March, 1829 ? Give different cases which might arise.

3. (a) How would you locate the corner of a lot when the original stake is lost ?

(b) How would you locate a concession line when part is lost ?

(c) How would you locate a concession line which was never run ?

(d) How would you locate a concession line when the whole is lost ?

4. (a) How would you re-survey Government town plots where original stakes are lost ?

(b) How would you re-survey town plots by Corporations where original stakes are lost ?

(c) How would you re-survey town plots by private persons where original stakes are lost ?

5. (a) Under what circumstances can an O. L. S., take affidavits ?

(b) How can an O. L. S. compel attendance of witnesses?

(c) To what extent is an O. L. S., allowed to pass over private property ?

(d) Are O.L.S. bound to keep Field Notes, and if so, how?

SUBJECT No. 10.

RE DITCHES AND WATER COURSES ACT.

1. (a) State the law and precedent as to appointing Engineer.

(b) State the law and precedent as to friendly meeting.

(c) State the law and precedent as to notifying the Engineer.

(d) State the law and precedent as to examination and award by Engineer.

(e) State the law and precedent as to completing work by Engineer when individuals fail.

(B) RE MUNICIPAL DRAINAGE.

2. (a) State law and precedent as to commencing work on Petition.

(b) State law and precedent as to appointing Engineer and oath of office.

(c) State law and precedent as to survey and assessment and report.

(d) State law and precedent as to adjoining municipalities.

(e) Define and give illustrations of the meaning of the terms "benefit liability," "injuring liability," and "outlet liability."

(c) RE REGISTRY ACT.

3. (a) State how plans should be prepared for registration.

(b) State how plans can be registered where surveys or sub-divisions have been made before 4th March, 1868.

(c) State how plans of cities, towns and villages, which were sub-divided at different times should be made and registered.

(D) RE MINING ACT.

4. (a) State how mining claims and locations should be surveyed, and plans and descriptions made in unsurveyed territory.

(b) State how mining claims and locations should be surveyed, and plans and descriptions made in surveyed territory.

SUBJECT No. II.

LEVELLING.

1. Describe the adjustments necessary for a Wye. Wherein do they differ in a Dumpy ?

2. Give a form for a field book and show typical set of observations reduced to a common Datum.

3. Give form for cross section book.

4. What is a level line ?

5. How would you take into account the sphericity of the earth and allow for it in actual work ?
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SUBJECT No. 12.

EVIDENCE.

1. Define the term evidence.
 2. What is the best evidence ?
 3. Secondary evidence. When is it admissible ?
 4. What is hearsay ? and when, if ever, is it allowable ?
 5. What position do you consider you occupy when acting as a Surveyor ? What attitude do you consider you should take with regard to evidence ?
 6. Draw up an affidavit in full to establish a post.
-

SUBJECT No. 14.

MINERALOGY AND GEOLOGY.

1. Define conformable and contorted strata. Interstratified and disrupting masses, and fissures and fractures of rock formations.
2. State situation and the constituent rocks of the Huronian and Silurian formations in Ontario.
3. In what geological formations, and in what localities do iron, corundum, nickel and gold, principally occur in Canada ?
4. What are the constituents of trap and green stones, and in what manner do they usually occur ?

5. What is Graphite, and what is usually called "Phosphates?"

In what localities in Canada do they principally occur?

6. Name some distinctive fossils of the carboniferous and Silurian formations; and name principal coal deposits of the Dominion.

SUBJECT No. 15.

BOTANY AND FOREST FLORA.

1. What are the parts of a flower? Illustrate by diagrams, and give full descriptions and the use of each part.

2. What is a fruit in Botany? Explain the structure of an apple, grape, almond, strawberry and pine-apple.

3. Describe the structure of endogenous and exogenous stems. How do they differ in growth?

4. Describe the germination of a plant.

5. Name ten trees of Ontario and give their botanical names. What are their economic uses.

LIST OF MEMBERS.

31st July, 1901.

The names of those members granted exemption by By-laws ratified by the Association are marked *.

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Abrey, George Brockitt, Toronto Junction,	10th Jan., 1860 D.L.S.
Allan, John Richard, Renfrew.....	6th Nov., 1894 Grad. S.P.S.
Aylsworth, Charles Fraser, Jr., Madoc.....	8th Jan., 1886 D.L.S.
Aylsworth, John Sidney, Selby, P.O. Box 23...	9th Jan., 1871 D.L.S.
Aylsworth, William Robert, Belleville, P.O. Box 2.....	8th Nov., 1861 D.L.S.
Baird, Alexander, Leamington.....	7th July, 1877 D.L.S., C.E.
Barrow, Ernest George, Hamilton.....	4th Oct., 1877 D.L.S., Mem. Can. Soc. C.E., City Engineer.
Bazett, Edward, Burk's Falls.....	8th July, 1881 D.L.S.
Beatty, David, Parry Sound.....	12th July, 1869 D.L.S.
Beatty, Herbert John, Eganville.....	8th Nov., 1893 Grad. S.P.S.
Beatty, Walter, Delta.....	19th July, 1858 D.L.S., M.P.P.
Bell, James Anthony, St. Thomas.....	11th Oct., 1875 D.L.S., Co. Engineer, Elgin. City Engineer, St. Thomas.
Bigger, Charles Albert, Ottawa, 68 Daly Ave..	6th Jan., 1882
Bolton, Ellsworth Doan, Listowel.....	7th Nov., 1899 B.A.Sc. (McGill)
Bolton, Lewis, Listowel.....	9th July, 1864 D.L.S.

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Boswell, Elias John, Peterborough.....	7th Nov., 1896 Grad. S.P.S.
Bowman, Clemens Dersteine, West Montrose.....	10th July, 1879
Bowman, Herbert Joseph, Berlin.....	7th Jan., 1887 D.L.S., Grad. S.P.S., Treasurer County Waterloo. Assoc. Mem. Can. Soc. C.E.
Bray, Edgar, Oakville.....	6th Oct., 1866 D.L.S.
Bray, Harry Freeman, Oakville.....	10th July, 1882
Bray, Samuel, Ottawa, Dept. of Indian Affairs..	6th Jan., 1877 C.E., D.L.S.
Brown, George Laing, Morrisburg.....	19th Feb., 1898 Grad. S.P.S.
*Brown, John Smith, Kemptville.....	8th July, 1852 D.L.S.
Browne, Harry John, Toronto. 18 Toronto st..	6th July, 1872 C.E.
Browne, William Albert, Toronto, 18 Toronto st.....	10th April, 1876
Burt, Frederick Percy, New York, N.Y.....	8th July, 1885 Manager and Treasurer Engineering News Pub. Co., 220 Broadway.
Butler, Matthew Joseph, 22 Wellington Place, Toronto.	11th Jan., 1878 M.I.C.E., Mem. Am. Soc. C.E., Mem. Can. Soc. C.E., C.E.
Byrne, Thomas, Sault Ste. Marie.....	15th July, 1862 D.L.S.
*Caddy, Cyprian Francis, Campbellford.....	10th July, 1860 D.L.S.
Caddy, John St. Vincent, Ottawa, 559 King st..	6th Oct., 1866 D.L.S.
Cameron, Alfred John, Peterborough.....	9th April, 1889
Campbell, Archibald William, Toronto, Parliament Building	10th April, 1885 C.E. Provincial Instructor in Road Making.
Carpenter, Henry, Stanley, B.A., Sc. (Toronto Univ.), Collingwood.....	25th Feb., 1899
Carre, Henry, 103 Sparks St., Ottawa.....	8th Nov., 1861 M.I.C.E. (Member of the Canal R.A. and C.E. (Tram. Coll. Dublin), D.L.S.
*Carroll, Cyrus, Prince Albert, Sask.....	10 Jan., 1860 Mem. Can. Soc. C.E., D.L.S.
Chapman, Joseph Plimvie Raby, Morrisburg.....	5th Jan., 1888 M.I.C.E., F.I.C.E., (Assoc. C.E. Assoc. Mem. Can. Soc. C.E., Chief Eng. M. & F.I.C.E.
Chapman, Allan George, Ch.....	8th July, 1876 D.L.S.

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Chalmers, John, Port Arthur, per Ont. & R.R. Ry Co.....	14th April, 1896 Grad. S.P.S.
Charlesworth, Lionel Clare, Rat Portage.....	14th April, 1896 Grad. S.P.S., Agent Bureau of Mines (Ont.).
*Cheesman, Thomas, Mitchell.....	11th July, 1856 D.L.S.
Chipman, Willis, Toronto, 103 Bay st.....	4th Oct., 1881 B.A.Sc. (McGill), Mem. Am. Soc. C.E.; Mem. Can. Soc. C.E.
Code, Abraham Silas, Alvinston.....	14th April, 1896
Cozens, Joseph, Sault Ste. Marie.....	7th July, 1875 D.L.S.
*Davidson, Alexander, Arkona.....	11th Oct., 1858 D.L.S.
Davis, Allan Ross, Napanee.....	8th Jan., 1886 B.A.Sc. (McGill.)
Davis, John, Alton.....	5th April, 1878
Davis, William Mahlon, Berlin.....	11th April 1885 Grad. R.M.Coll., (Kingston), Town Engineer.
Deacon, Thomas Russ, Rat Portage.....	12th Nov., 1892 Grad. S.P.S., Mgr. Mikado Mine.
Deans, William James, Oshawa.....	11th July, 1884
DeMorest, Richard Watson, Sudbury.....	9th April, 1889 M.E.
Dickson, James, Fenelon Falls.....	6th April, 1867 D.L.S.
Dobbie, Thomas William, Tilsonburg.....	11th July, 1856 D.L.S.
Dobie, James Samuel, Port Arthur.....	21st Feb., 1898 B.A.Sc. (Toronto Univ.).
Doupe, Joseph, Winnipeg, Man., 169 Edmonton st.....	13th Jan., 1863 D.L.S., P.L.S. (Man.), C.E. (McGill.), P.L.S. (B.C.).
Ducker, William A., Winnipeg, Man., 334 Pacific ave.....	6th April, 1882 D.L.S., P.L.S. (Man.) Swamp Lands Com.
Esten, Henry Lionel, Toronto, 157 Bay st....	7th Jan., 1887
Evans, John Dunlop, Trenton.....	8th July, 1864 D.L.S., C.E., Chief Eng. Cent. Ont. Ry., Eng. for Weddell Bridge & Engine Works.
Fair, John, Brantford.....	13th April, 1875

184 ASSOCIATION OF ONTARIO LAND SURVEYORS.

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Fairbairn, Richard Purdom, Toronto, 127 Major st.....	7th Oct., 1876 Surveyor for Dept. of Pub. Works, Ontario.
Fairchild, Charles Court, Simcoe.....	9th April, 1894 Grad. S.P.S.
Fairchild, William Howard, Simcoe.....	17th Feb., 1900
Farncomb, Alfred Ernest, Fort William.....	9th April, 1895
Farncomb, Frederick William, London, 213 Dundas st.....	6th Nov., 1889
Fawcett, Thomas, Niagara Falls.....	6th Jan, 1881 Dom. Topographical Surveyor.
Fitton, Charles Edward, Orillia, Box 142....	10th April, 1879 D.L.S.
Flater, Frederick William, Petrolea.....	9th April, 1888
Ford, William Butters, Hamilton, 42 James St., N.....	21st Feb., 1898
Francis, John James, Sarnia P.O., Box 304...	16th Oct., 1861 D.L.S.
*Fraser, Charles, Wallaceburg.....	5th Aug., 1847 D.L.S.
Galbraith, William, Bracebridge.....	4th April, 1883 D.L.S.
Gamble. Killaly, Toronto, 88 Charles st.....	6th April, 1888 D.L.S., P.L.S. (Man.), Captain R.A. (Ret'd).
Gardiner, Edward, St. Catharines.....	6th Jan., 1866 D.L.S.
Gaviller, Maurice, Collingwood, Box 164.....	6th Jan., 1866 C.E. (McGill), D.L.S.
Gibson, Harold Holmes, Willowdale.....	8th Sept., 1891
*Gibson, James Alexander, Oshawa.....	7th April, 1855 D.L.S.
Gibson, Peter Silas, Willowdale.....	19th July, 1858 C.E. M.S. (Mich. Univ.) D.L.S., Mem. Can. Soc. C.E., Engineer Tp. of York.
Gibson, Wilbert Silas, Willowdale.....	21st Feb., 1898
Gillon, Douglas John, Fort Frances.....	9th Nov., 1895 Grad. R.I.E. Coll.
Graydon, Aquila Ormsby, London.....	8th July, 1880 City Engineer.

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Hanning, Clement George, Preston, Lock Box 130.....	19th July, 1858 D.L.S., C.E. (Trin. Coll., Dublin).
Hart, Milner, Toronto, 103 Bay st.....	11th July, 1863 D.L.S.
Harvey, Thomas Alexander, Steelton, Penn....	13th Nov., 1893 C.E. (R.P.I., Troy, N.Y.)
Heaman, John Andrew, London, Albion Building.....	16th Nov., 1896
Henry, Frederick, London, Albion Building..	7th April, 1887
*Hermon, Royal Wilkinson, Rednersville....	13th July, 1857 D.L.S.
Hobson, Joseph, Montreal, G. T. Ry. Office.....	3rd Oct., 1855 D.L.S., Chief Eng. Grand Trunk Railway System.
Hopkins, Marshall Willard, Hamilton.....	13th Nov., 1893 D.L.S., B.A.Sc. (McGill), Assoc. Mem. Can. Soc. C.E., Chief Engineer I.R.R.C.
Hutcheon, James, Guelph.....	10th Nov., 1891 Grad. S.P.S., City Engineer.
Irwin, James Moore, Rat Portage.....	13th Jan., 1863 D.L.S.
Jackson, James Herbert, Windsor.....	16th Feb., 1901
James, Darrell Denman, Michipicoten Harbour...	3rd Nov., 1891 B.A., B.A.Sc. (Toronto Univ)
James, Silas, Toronto, 114 Shuter St.....	19th July, 1858 D.L.S.
Jones, Charles Albert, Petrolea.....	8th April, 1881 D.L.S.
Jones, John Henry, Sarnia, Box 194.....	10th Oct., 1886 D.L.S.
Jones, Thomas Henry, Brantford.....	10th Oct., 1878 B.A.Sc. (McGill). D.L.S. City Engineer.
*Keefer, Thomas Coltrin, Ottawa.....	14th Aug., 1840 D.L.S., C.E.
Kennedy, James Henry, St. Thomas.....	7th April, 1887 C.E. (Toronto Univ), Mem. Can. Soc. C.E., Engineer of V.V. & E. Ry.
Kirkpatrick, George Brownly, Toronto, Dept. of Crown Lands.....	13th April, 1863 D.L.S., Director of Surveys.
Laird, James Stewart, Essex.....	6th April, 1867 D.L.S.

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Laird, Robert, Rat Portage.....	11th Nov., 1887
Grad. S.P.S.	
Lewis, John Bower, Ottawa, Brunswick House	4th Oct., 1883
D.L.S., P.L.S. (Quebec), C.E.	
Lougheed, Aaron, Port Arthur,.....	12th Nov., 1888
D.L.S.	
*Low, Nathaniel Edward, Wiarton.....	11th July, 1856
D.L.S.	
Lumsden, Hugh David, Toronto, 63 Homewood ave.....	4th Jan., 1866
C.E., D.L.S., M.I.C.E., Mem. Can. Soc. C.E.	
Macdougall, Allan Hay, Port Arthur.....	11th April, 1859
D.L.S., Town Engineer.	
MacKay, James John, Woodstock.....	25th Feb., 1899
MacKenzie, William, Sarnia.....	11th April, 1896
Grad. R.M.C. (Kingston).	
MacKenzie, William Lyon, Cranbrook, B.C.....	7th April, 1887
C.E.	
MacPherson, Duncan, Montreal, P.Q.....	9th Jan., 1884
Grad. R.M.C., M.I.C.E., Mem. Can. Soc. C.E., Div. Eng. Eastern Div. C.P. Ry.	
McAree, John, Rat Portage.....	6th April, 1867
Dominion Topographical Surveyor, B.A.Sc., (Toronto Univ)	
McCubbin, George Albert, St. Thomas, City Engineer's Office.....	9th Nov., 1895
Assist. City Engineer.	
McDonell, Augustine, Chatham, 4 & 5 Ebert's Block.....	11th July, 1863
D.L.S.	
McDowall, Robert, Owen Sound.....	11th Nov., 1890
Grad. S.P.S., Town Engineer	
McEvoy, Henry Robinson, St. Marys.....	10th July, 1875
D.L.S.	
McFadden, Moses, Neepawa. Man.....	13th April, 1858
D.L.S., P.L.S. (Man.)	
McFarlen, George Walter, Toronto, City Hall, Assistant City Engineer's Office.....	11th Nov., 1889
Grad. S.P.S.	

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
McGeorge, William Graham, Clatham, Box 225.....	8th Jan., 1866 D.L.S.
McGrandle, Hugh, Huntsville.....	5th Jan., 1883 D.L.S.
McKay, Owen, Windsor, P.O. Box 167.....	7th Jan., 1887 Grad. S.P.S., Chief Eng. D. & L. E. Ry.
McKenna, John Joseph, Dublin.....	9th July, 1860 D.L.S.
McLatchie, John, Nelson, B.C., P.O. Box 128....	9th Jan., 1864 D.L.S., P.L.S. (Que., Man. and B.C.).
McLean, James Keachie, Elora.....	8th April, 1876 D.L.S.
McLean, William Arthur, Toronto, Parliament Buildings	21st Feb., 1898 Secretary of Roads.
McLennan, Murdoch John, Williamstown....	13th Nov., 1893 B.A.Sc. (McGill), D.L.S.
McLennan, Roderick, Toronto, 115 Avenue Rd.....	20th June, 1846 D.L.S.
McNab, John Duncan, Owen Sound.....	9th Oct., 1879
McNaughton, Finlay Donald, Cornwall.....	25th Feb., 1899
McPherson, Archibald John, Brockville.....	10th April, 1897 B.A.Sc. (Toronto Univ.)
McPherson, Charles Wilfrid, Dawson, N.W.T. . c/o Dep't of Interior	21st Feb., 1899
McPhillips, George, Winnipeg,.....	9th July, 1885 D.L.S., P.L.S. (Man.)
Manigault, William Mazyck, Strathroy, P.O. Box 300.....	8th July, 1876 D.L.S.
Marshall, James, Holyrood.....	6th Oct., 1866 D.L.S.
Meadows, William Walter, St. Thomas.....	21st Feb., 1898 Grad. S.P.S.
Miles, Charles Falconer, 268 Triangle St., Buffalo, N.Y.....	13th Jan., 1862 D.L.S.
Miller, Frederick Fraser, Napanee.....	8th Jan., 1885
Moore, John MacKenzie, London, Albion Building.....	9th Oct., 1879

NAME AND ADDRESS

DATE OF ADMISSION BY BOARD.

Laird, Robert11th Nov., 1889
Lewis, John10th April, 1879
House7th July, 1886
Lougheed,	Ottawa.....9th Jan., 1884
	(Que.) Chief Eng. Can. Atlantic and P. Ry.
*Low, J.	Bloor St. E.....10th Jan., 1860
C.E.
Lumsden, J.	Toronto, 157 Bay st..6th Oct., 1886
By H.7th April, 1854
21st Feb., 1898
Macdonald, J.12th Nov., 1892
	Grad. S.P.S.
M8th July, 1859
	D.L.S.
	Dawson City, Yukon Dist..12th July, 1869
	Commissioner for Yukon District.
	Francis, Chatham.....14th April, 1892
	D.L.S.
	James, Little Current.....5th Jan., 1883
	Alexander, Montreal, P.Q...16th July, 1863
	Can. Soc. C.E., Chief Engineer Can. Pac. Ry.
	Herbert, Ottawa,
12th Nov., 1888
	Grad. S.P.S., Assoc. Mem. Can. Soc. C.E.
	Blake, Port Arthur.....6th Jan., 1882
	D.L.S., C.E. (Toronto Univ.)
	Edward Joseph, Ottawa.....11th Nov., 1887
	D.L.S.
	George Charles, Aylmer, P.Q.....11th July, 1868
	D.L.S., P.L.S. (Que.)
	Carl, Montreal, 340 Mountain St.....25th Feb., 1899
	B.A.Sc. (McGill.)
	Samuel Henry, Rat Portage.....17th July, 1880
	Vaughan Maurice, St. Catharines...5th April, 1887
	James, Glencoe.....11th July, 1885
	Grad. S.P.S.
	Franklin Joseph, Kirkfield.....21st Feb., 1898
	(Grad. S.P.S., Asst. Engineer Trent Canal.

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Roger, John, Mitchell.....	10th Nov., 1888
Grad. S.P.S.	
*Rombough, Wm. R., Toronto, 61 Walton St....	14th Nov., 1848
D.L.S.	
Rorke, Louis Valentine, Sudbury.....	14th April, 1890
D.L.S.	
Ross, George, Welland.....	10th July, 1879
B.A.Sc. (McGill), D.L.S.	
*Rubidge, Tom S., Cornwall.....	9th Feb., 1849
D.L.S., Asst. Eng. Dept. Rys. and Canals.	
Russell, Alexander Lord, Port Arthur.....	16th April, 1873
D.L.S., P.L.S. (Que.).	
Sankey, Villiers, Toronto, City Hall.....	11th Jan., 1878
D.L.S., City Surveyor.	
Saunders, Bryce Johnston, Regina, N.W.T.....	7th Jan., 1885
B.A.Sc. (McGill), D.L.S.	
Scane, Thomas, Ridgetown.....	7th Jan., 1865
D.L.S.	
*Schofield, Milton C., 185 14th St. Buffalo, N.Y.....	28th Sept., 1843
D.L.S.	
Schwitzer, John Edward, Rat Portage.....	16th Nov., 1896
Towr Engineer, B.A.Sc. (McGill).	
Seager, Edmund, Rat Portage.....	8th July, 1861
D.L.S.	
Selby, Henry Walter, Dinorwic, Dist. of Rainy River	8th Jan., 1876
D.L.S.	
Sewell, Henry DeQuincy, Toronto, 29 St. Mary St.	9th July, 1885
D.L.S., A.M.I.C.E.	
Shaw, John Henry, Pembroke.....	17th Feb., 1900
Grad. S.P.S.	
Silvester, George Ernest, Sudbury.....	12th Nov., 1892
Grad. S.P.S.	
Sing, Josiah Gershom, Meaford, P.O. Box 3.....	9th Jan., 1879
D.L.S.	
Smith, Angus, Stratford.....	14th April, 1896
Grad. S.P.S., City Engineer.	
Smith, George, Woodville, P.O. Box 77. . .	7th April, 1881
Engineer for Co. Victoria and four Townships.	
Smith, Henry, Toronto, Crown Lands Dept...	8th Nov., 1861
D.L.S., Mem. Can. Soc. C.E.	
Speight, Thomas Bailey, Toronto, Yonge St. Arcade.....	6th Jan., 1882
D.L.S.	

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Squire, Richard Herbert, Brantford, 103 Dalhousie St.....	14th April, 1896 B.A.Sc. (Toronto University).
Steele, Edward Charles, Port Arthur.....	9th April, 1889 Assoc. Mem. Can. Soc. C.E.
Stewart, Elihu, Ottawa, Dept. of the Int.....	8th April, 1872 D.L.S., Chief Inspector of Timber and Forestry.
*Stewart, George Alexander, Calgary, Alta....	8th July, 1852 D.L.S.
Stewart, John, Montreal.....	11th Nov., 1887 D.L.S.
Stewart, Walter Edgar, Aylmer.....	12th April, 1892
*Strange, Henry, Rockwood.....	30th Nov., 1838 D.L.S., C.E.
Stull, William Walter, Sudbury.....	17th Feb., 1900 B.A.Sc. (Toronto Univ.)
Taylor, William Verner, Gananoque.....	7th Nov., 1896 Grad. S.P.S.
Traynor, Isaac, Dundalk.....	16th April, 1873 D.L.S.
Turnbull, Thomas, Winnipeg, Man., C. P. R. Eng. Office.....	6th July, 1878 D.L.S., C.E. (Toronto Univ.)
Tyrrell, James Williams, Hamilton, 42 James st. n.....	8th April, 1885 C.E. (Toronto Univ.), D.L.S., Co. Eng. for Wentworth.
*Unwin, Charles, Toronto, 126 Seaton st....	12th April, 1852 D.L.S.
Ure, Frederick John, Woodstock.....	7th April, 1887 C.E.
Van Buskirk., William Fraser, Rosland	7th April, 1888 Grad. R.M. Coll. (Kingston), City Engineer.
Van Nostrand, Arthur J., Toronto, Yonge St. Arcade.....	30th Oct., 1882 D.L.S.
Wadsworth, Vernon Bayley, Toronto, 103 Bay st.....	9th April, 1864 D.L.S.
Wagner, William, Ossowo, Man.....	13th April, 1858 D.L.S.
Walker, Alfred Paverley, Toronto, Room 508, Union Station, C. P. Ry., Eng. Office.....	6th Jan., 1882 D.L.S., Mem. Can. Soc. C.E.

LIST OF MEMBERS.

191

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Wallace, James Nevin, Calgary, Alta.....	21st Feb., 1898 B.A., B.E. (Trin. Coll Dublin).
Ward, Archeson Thomas, Wabigoon Dist. of Rainy River	10th April, 1897
Warren, James, Walkerton, P.O. Box 190.....	7th Oct., 1864 D.L.S.
Watson, John McCormack, Orillia, P.O. Box 224.....	13th April, 1892
*Weatherald, Thomas, Goderich, P.O. Box 273.....	12th Jan., 1856 D.L.S., C.E.
Weekes, Melville Bell, Brantford.....	17th Feb., 1900 B.A.Sc. (Toronto Univ.)
West, Robert Francis, Orangeville.....	7th April, 1881
Wheelock, Charles Richard, Orangeville.....	7th Jan., 1886 Treasurer County of Dufferin.
Whitson, James Francis, Toronto, Crown Lands Dept.....	9th Jan., 1886
Wicksteed, Henry King, Cobourg.....	7th Jan., 1886 D.L.S., C.E.
Wiggins, Thomas Henry, Finch, Ont.....	10th Nov., 1891 Grad. S.P.S., D.L.S., Town Engineer.
Wilde, John Absalom, Sault Ste. Marie.....	9th April, 1889
Wilkie, Edward Thomson, Carleton Place....	11th April, 1891 D.L.S.
Williams, David, 220 Queen St., Kingston.....	9th April, 1864 D.L.S.
*Winter, Henry, Thornyhurst.....	11th July, 1853 D.L.S., C.E.
*Wood, Henry O., Billings' Bridge.....	10th Oct., 1855 D.L.S.
*Yarnold, William Edward, Port Perry, P.O. Box 44.....	7th April, 1854 D.L.S.

REGISTERED AND WITHDRAWN.

The names of those who have become "Associates" under By-law No. 39 are marked *; and under By-Law No. 45 are marked †.

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Anderson, John Drummond, Trail, B.C.....	13th April, 1892
Apsey, John Fletcher, Cumberland, Md.....	6th Jan., 1886
Grad. S.P.S.	
Aylsworth, Charles Fraser, Sr., Madoc.....	2nd April, 1861
D.L.S.	
Blake, Frank Lever, Toronto, Meteorological Office	13th April, 1875
D.L.S.	
Bell, Andrew, Almonte.....	6th Oct., 1866
D.L.S.	
Bolton, Jesse Nunn, Toronto, 264 Major St.....	6th April, 1867
Booth, Charles Edward Stewart, Westmount, P. Q.....	6th April, 1882
Bowman, Arthur Meyer, Mahan, Beaver Co., Pa.....	11th Nov., 1887
Grad. S.P.S., Staff of U.S. Engineers.	
Bowman, Franklin Meyer, Bellevue, Allegheny Co., Pa.....	11th April, 1892
Grad. S.P.S., Engineer Structural Iron Works.	
Brady, James, Victoria, B.C., P.O. Box 815..	15th July, 1862
M.E.	
Burnet, Hugh, Victoria, B.C.....	5th April, 1887
P.L.S. (B.C.).	
Cambie, Henry John, Vancouver, B.C.....	8th July, 1861
P.L.S. (B.C.).	
Carbert, J. Alfred, St. Joseph, Mich.....	7th April, 1876
D.L.S. Staff of U. S. Engineers.	
Coleman, Richard Herbert, Toronto, Canada Co. Offices, Imperial Bank Chambers....	6th Oct., 1877
Drewry, William Stewart, Ottawa, Dept. of the Interior.....	5th April, 1883
D.L.S.	
Edwards, George, Thurso, P.Q.	6th Jan., 1866
D.L.S.	
*Ellis, Henry Disney, Kuching, Sarawak, Borneo	7th April, 1877
D.L.S., Commr. of Pub. Works and Surveys.	

LIST OF MEMBERS.

193

NAME AND P.O. ADDRESS.	DATE OF ADMISSION BY BOARD.
Galbraith, John, Toronto, School of Prac. Science.....	13th April, 1875 M.A., D.L.S., Prof. Engineering. S.P.S.
Gibbons, James, Ottawa, Dept. of the Interior...	15th April, 1890 Grad. S.P.S., Dominion Topographical Surveyor.
Gibson, George, St. Catharines.....	10th April, 1860 D.L.S.
*Gilmour, Robert, Toronto, c/o Western Loan Company.....	11th April, 1856 D.L.S., C.E.
Green, Thomas Daniel, Dawson City	7th Jan. 1885 D.L.S.
Griffin, Albert Dyke, Collegiate Institute, Wordstock.....	11th Nov., 1890 B.A., Mathematical Master.
*Harris, John Walter, Winnipeg	6th Oct., 1866 P.L.S. (Man.), D.L.S., Assessment Com.
Henderson, Eder Eli, Henderson P.O., Maine	7th April, 1887 Grad. S.P.S.
Hermon, Ernest Bolton, Vancouver, B.C.....	7th Oct., 1885 P.L.S. (B.C.), D.L.S.
Innes, William Livingstone, Simcoe.....	14th April, 1892 C.E. (Toronto Univ.).
Jephson, Richard Jermy, Calgary, Alta.....	7th April, 1877 P.L.S. (B.C.), D.L.S.
Johnson, Sydney Munnings, Greenwood, B.C..	9th Nov., 1895
Johnston, Robert Thornton, New York, N.Y., 944 Amsterdam Ave.....	9th April, 1889
Kains, Tom, Victoria, B.C.....	11th July, 1873 D.L.S. P.L.S. (B.C.).
Kirk, John Albert, Rossland, B.C.....	6th July, 1877 D.L.S., P.L.S. (J.C.).
*Kippax Hargreaves, Huron, South Dakota.....	7th July, 1877 C.E. (Toronto Univ.), Assistant to Surveyor General.
*Klotz, Otto Julius, Ottawa, 437 Albert st.....	6th Jan., 1876 C.E. (Mich. Univ.), Dominion Topographical Surveyor.
Lane, Andrew, Sparrow's Point, Md.....	4th April, 1895 Grad. S.P.S., Draftsman Maryland Steel Co.

REGISTERED AND W

The names of those who have become "Ass.
marked *; and under By-Law

NAME AND P.O. ADDRESS.

Anderson, John Drummond, Trail	
Apsey, John Fletcher, Cumberland, Md...	Oct., 1856
Grad.	Engineer,
Aylsworth, Charles Fraser, Sr	11th Nov., 1892
Blake, Frank Lever, Toronto Meteorological Office	Alta... 1st Nov., 1881 (B.C.).
Bell, Andrew, Almonte....	South.... 12th Nov., 1892
Bolton, Jesse Nunn, Toronto	9th April, 1895
Booth, Charles Edward Westmount, P. Q...	n, P.Q..... 5th April, 1878
Bowman, Arthur Mey Beaver Co., Pa...	Man. Soc. C.E. Alta..... 12th Oct., 1872 P.L.S. (B.C.).
Grad.	
Bowman, Franklin M Allegheny Co.,	m. Ottawa, 9th April, 1880
Grad.	D.L.S.
Brady, James, Victoria	Ireland..... 13th April, 1875 C.E., D.L.S.
Burnet, Hugh, Victoria	City, Arizona..... 7th April, 1875
Cambie, Henry	Prince Albert, Sask..... 8th April, 1870 D.L.S.
Carbert, J. Alfred Henry, Ottawa, Superior.....	16th April, 1873 D.L.S.
Coleman, Richard Co. Office	Robinson, London, 7th April, 1881
Drewry, William Dept. of	St..... D.L.S., P.L.S. (Man.)
Thomas, Kipiegan, Man.....	9th Nov., 1888
Edwards, Edward Birdsall, Peterborough.....	9th Jan., 1879 B.A.Sc. (McGill), D.L.S.
*Ellis, Henry Edmund, New Westminster, Brit.	11th Nov., 1890 P.L.S. (B.C.).

LIST OF MEMBERS.

195

2. ADDRESS.

DATE OF ADMISSION BY BOARD.

avens, Coral, Mich.....	4th Oct., 1882
enwood, B.C.....	6th Oct., 1877
S. (B.C.).	
Vancouver, B.C.....	12th April, 1890
P.L.S. (B.C.).	
Winnipeg Man.....	7th Oct., 1864
C.E., D.L.S., M.P.	
nto.....	19th July, 1858
C.E., D.L.S.	
Beaufort, Toronto,	
Prac. Science.....	6th April, 1882
on Topographical Surveyor, Lect. in Surveying.	
ohn, Vancouver, B.C.....	5th Oct., 1876
P.L.S. (B.C.), D.L.S.	
Thomas Henry, Vancouver, B.C.....	8th April, 1870
C.E., P.L.S. (B.C.), D.L.S.	
s, John Richard Odlum, Kamloops, B.C.....	5th Jan., 1887
D.L.S., P.L.S. (B.C.).	
allace, Charles Hugh, 36 Dame St., Dublin, Ire.,	9th Nov. 1889
C.E. (Trin. College, Dublin), Dom. Gov. Surveyor.	
Weekes, Abel Seneca, Wetaskiwin, Alta....	12th April, 1890
D.L.S.	
Wheeler, Arthur Oliver, New Westminster,	
B.C.	8th July, 1881
P.L.S. (B.C.), D.L.S.	
Willson, Alfred, Toronto, Can. Co. Offices,	
Imperial Bank Chambers.....	6th Oct., 1866
D.L.S., Commissioner Canada Company.	
Wilkins, Frederick William, Ottawa,	
Dept. of the Interior.....	6th Jan., 1877
Dominion Topographical Surveyor.	

SUMMARY.

Active members subject to dues.....	196
Active members exempted from dues.....	19
Withdrawn from practice (including 9 Associates)	69
Dead	34
Total number enrolled since incorporation.....	318

Deceased Members.

NAME.	LATE RESIDENCE.	DATE OF P. L. S. CERTIFICATE.	DATE OF O. L. S. REGISTRATION	DIED.
Bolger, Francis.....	Lindsay.....	10th October, 1863.....	1892.....	3rd November, 1895.
Bolger, Thomas Oliver.....	Kingston.....	6th July, 1865.....	1892.....	20th September, 1895.
Bowman, Leander Meyer.....	Toronto.....	14th April, 1862.....	1892.....	14th May, 1900.
Brown, David Rose.....	Cornwall.....	10th October, 1850.....	1892.....	10th June, 1897.
Burke, William Robert.....	Ingersoll.....	5th April, 1878.....	1892.....	26th September, 1897.
Caddy, Edward C.....	Cobourg.....	18th December, 1846.....	1892.....	17th May, 1897.
Coad, Richard.....	Glencoe.....	8th October, 1879.....	1892.....	22nd January, 1898.
Creswick, Henry.....	Barrie.....	8th July, 1864.....	1892.....	19th October, 1897.
Cromwell, Joseph M. O.....	Perth.....	1st October, 1846.....	1892.....	December, 1900
Davidson, Walter Stanley.....	Sarnia.....	9th April, 1884.....	1892.....	3rd April, 1897.
Deane, Michael.....	Windsor.....	26th May, 1848.....	1892.....	22nd March, 1898.
DeGurse, Joseph.....	Windsor.....	5th April, 1883.....	1892.....	—, 1901.
FitzGerald, James William.....	Peterborough.....	13th July, 1857.....	1892.....	27th July, 1899.
Foster, Frederick Lucas.....	Toronto.....	9th April, 1863.....	1892.....	— April, 1898.
Fowle, Albert.....	Orillia.....	13th January, 1863.....	1892.....	17th April, 1893.
Gibbs, Thomas Fraser.....	Adolphustown.....	31st May, 1841.....	1892.....	14th December, 1898.
Gilliland, Thomas Brown.....	Eugenia.....	11th July, 1868.....	25th January, 1890.....	5th July, 1896.
Haskins, William.....	Hamilton.....	5th July, 1855.....	1892.....	21st October, 1898.
Hewson, Thomas Ringwood.....	Hamilton.....	6th July, 1877.....	1892.....	6th May, 1896
Howitt, Alfred.....	Gourrock.....	12th January, 1856.....	1892.....	22nd January, 1900.
Kirk, Joseph Green.....	Stratford.....	16th February, 1843.....	1892.....	11th June, 1899.
Lynch-Staunton, Francis H.....	Hamilton.....	11th October, 1856.....	1892.....	—, 1898.
MacMillan, James Alexander.....	Calgary.....	6th January, 1877.....	24th December, 1894.....	16th October, 1897.
MacNab, John Chisholm.....	Hamilton.....	8th January, 1880.....	1892.....	— July, 1900.
McCallum, James.....	Fort Francis.....	30th March, 1849.....	1892.....	13th January, 1899.
Malcolm, Sherman Morgan.....	Blenheim.....	11th October, 1858.....	1892.....	21st September, 1898.
Ogilvie, John Henry.....	Rat Portage.....	8th April, 1876.....	24th April, 1894.....	17th January, 1897.
Padder, James Robert.....	Doon.....	10th November, 1891.....	23rd December, 1892.....	22nd December, 1899.
Reid, James Hales.....	Bowmanville.....	6th October, 1866.....	1892.....	11th October, 1894.
Robinson, William.....	London.....	— May, 1846.....	1892.....	December, 1900
Tiernan, Joseph Martin.....	Tilbury Centre.....	7th January, 1886.....	1892.....	— December, 1896.
Thomson, Augustus Clifford.....	Chicago.....	14th January, 1861.....	1892.....	14th March, 1895.
Walsh, Thomas William.....	Simcoe.....	25th April, 1842.....	1892.....	4th July, 1897.
Wheelock, Charles John.....	Orangeville.....	—, 1856.....	1892.....	

EXTRACTS FROM THE

BY-LAWS AND STATUTES

RELATING TO THE

ADMISSION AND EXAMINATION OF

Ontario Land Surveyors.

BY-LAWS.

EXAMINATIONS.

28. Candidates for admission to apprenticeship are to be examined as follows, in the subjects prescribed in Rev. Stat. Ont., c. 180, s. 22; and no candidate shall be admitted unless he obtains at least the minimum marks set opposite each subject, and at least a total of 550.

SUBJECT.	Max. Marks.	Min. Marks.
1. Penmanship.....	50	30
2. (a) Orthography (including dictation).....	50	40
(b) English Grammar.....	50	25
3. Arithmetic (Fractions, Decimals, Square Root)	100	60
4. Logarithms and Algebra (including Equations 1st Degree)	100	60
5. Euclid (Books 1, 2, 3 and 4).....	100	60
6. Plane Trigonometry and Rules for Spherical..	100	50
7. Mensuration of Superficies ...	50	30
8. Linear Drawing (use of ruling pen and construc- tion of scales)	50	25
9. Canadian and General Geography.....	50	25
10. Canadian History.....	50	25

29. Candidates for admission to practice are to be examined as follows in the subjects prescribed in Rev. Stat. Ont, c. 180, s. 25; and no candidate will be admitted unless he obtains at least the minimum marks set opposite each subject, and at least a total of 1,000.

SUBJECT.	Max. Marks.	Min. Marks.
1. Geometry, including the first 6 books of Euclid, excepting the last thirteen propositions of the fifth book.....	100	50
2. Algebra (simple and Quadratic Equations, Pro- gressions and Exponents)	100	50
3. Trigonometry (Plane and Spherical).....	100	60
4. Mensuration of superficies and laying out and dividing land.....	150	75
5. Descriptions by metes and bounds.....	100	75

SUBJECT.	Max. Marks.	Min. Marks.
Surveying Instruments for survey- ing.....	100	70
Trigonometry, including finding of Time, Latitude, Azimuth, Variation of Drawing Meridian Lines.....	50	30
.....	150	90
.....	150	90
Registry Act, Municipal Act, relate to surveys and drainage), Water-courses Act.....	100	50
.....	50	35
..... Evidence and drawing up Affidavits	80	40
..... Field notes and preparing of Plans...	100	60
..... and Mineralogy, (rudiments of).....	75	40
..... Botany and the Forest Flora of	50	25

A candidate for admission to practice obtains a total of 1,000 marks, but fails to obtain the marks in, at least, two of the subjects, such a candidate at a subsequent examination be examined in two subjects in which he has failed.

Chapter 180, R.S.O. 1897.

(An Act respecting Land Surveyors.)

* * * * *

The said Board shall meet at the office of the Commissioner of Crown Lands, on the second Monday of the month of February, in every year, unless such Monday be a holiday (in which case they shall meet on the day next thereafter not being a holiday), and may adjourn such meeting from time to time if they deem it necessary. R.S.O. 1887, c. 152, s. 6. 60 V. c. 27, s. 1.

* * * * *

APPRENTICES.

22. No person shall be admitted as an apprentice with any Ontario Land Surveyor unless he has previously passed an examination to the satisfaction of the Board of Examiners, in penmanship, orthography, English gram-

mar, arithmetic, algebra (including square-root logarithms and quadratic equations), Euclid (first four books and deductions), plane trigonometry, spherical trigonometry as far as and including the solution of right-angled triangles, mensuration, practical geometry (including the use of ruling-pen and the construction of plane and comparative scales), Canadian and general geography and Canadian history, and has obtained a certificate of such examination and of his proficiency from the Board. 60 V. c. 27, s. 2.

23. Every applicant shall before being so examined pay to the Secretary-Treasurer of the Association the fees chargeable as hereinafter provided for the said examination and certificate. R.S.O. 1887, c. 152, s. 8.

Examination
and Certificate
Fees.

24. Applicants for examination previous to apprenticeship shall give one month's notice to the Secretary of the Board of their intention to present themselves for examination, and shall pay to the said Secretary the fee for receiving and entering such notice. R.S.O. 1887, c. 152, s. 9.

Notice to be
given by Appli-
cants.

QUALIFICATION FOR ADMISSION TO PRACTISE.

25. Except as hereinafter provided no person shall be admitted to practise as a land surveyor in and for Ontario until he has attained the full age of 21 years, and has passed an examination before the Board of Examiners in the following subjects, viz., geometry, including the first six books of Euclid (with the exception of the last thirteen propositions of the fifth book), algebra, including progressions, plane and spherical trigonometry, mensuration of superficies, laying out and dividing of land, descriptions by metes and bounds for deeds and other documents, the use and adjustment of surveying and levelling instruments, the laying out of curves, practical astronomy, including finding of time, latitude, longitude, azimuth, variation of the compass, and drawing meridian lines, the Acts relating to the survey of lands in Ontario,

Qualification
for Admission
to Practise.

Rev. Stats.
cc. 36, 136 ;
cc. 226, 285.

The Mines Act, The Registry Act, so far as it refers to plans, the Municipal Acts, so far as they relate to roads, surveys and drainage, *The Drainage Act, The Ditches and Watercourses Act*, the theory and practice of levelling, the principles of evidence, drawing of affidavits, taking of field notes and preparing plans, the rudiments of geology and mineralogy, elementary botany and the forest flora of Canada, and the sufficiency of his surveying instruments, and has served regularly and faithfully, for three successive years, except as is in this section hereinafter provided, under an instrument in writing duly executed before two witnesses, as apprentice to an Ontario Land Surveyor, duly admitted and practising therein as such, nor until he has received from the said land surveyor a certificate of his having so served during the said period, or proves to the satisfaction of the Board that he has so served. R.S.O. 1887, c. 152, s. 10. 60 V. c. 27, s. 3.

Apprentice-
ship.

Attendance of
Apprentice at
School of Prac-
tical Science or
Institution with
Similar Course
of Study.

26. Any person serving as an apprentice as hereinbefore provided, may, with the permission of the Board of Examiners attend the Ontario School of Practical Science, or any school, college, or university, the course of study in which is, in the opinion of the Board sufficiently similar to that in the Ontario School of Practical Science, for the purpose of taking any course of study which includes any subjects required for the final examination for admission to practise as a land surveyor, but the total period of such apprenticeship and of such course of study shall not exceed the period of four years from the date of the articles of apprenticeship as above mentioned, and not less than three years of the said period of four years shall be passed in the actual service of a practising Ontario Land Surveyor. 60 V. c. 27, s. 4.

Persons quali-
fied in other
British Domin-
ions may be ad-
mitted to Prac-
tise in Ontario.

27. In case a person who has attained the full age of 21 years and who has been practising as a land surveyor in any of His Majesty's dominions other than this Province, shall satisfy the Board of Examiners that the qualifications for practising required of such person in the said dominion, were sufficiently similar to those required in this Province, and shall produce to the said Board his diplomas or certificates, such persons shall not be required to serve as an apprentice, or shall only be required

to serve during such period not exceeding three years as the said Board may consider requisite, after which such person shall, on complying with the other requirements of this Act, have the right to undergo the final examination, or such portions thereof as the said Board may consider necessary, and shall, if found qualified, practise as a land Surveyor in Ontario. 60 V. c. 27, s. 6.

28. The privilege of a shortened term of apprenticeship shall also be accorded to any graduate of the Royal Military College at Kingston, or of the Ontario School of Practical Science, in civil engineering or in mining engineering, or of the McGill College, Montreal, in civil engineering or in mining engineering, and such person shall not be required to pass the preliminary examination herein before required for admission to apprenticeship with a land surveyor, but shall only be bound to serve under articles with a practising land surveyor, duly filed as required by section 32 of this Act, during twelve successive months of actual practice, after which, on complying with all the other requirements, he may undergo the examination prescribed by this Act. R.S.O. 1887, c. 152, s. 14. 60 V. c. 27, s. 7 (1).

Graduates of Royal Military College, Kingston, or of Ontario School of Practical Science, and McGill College, Montreal, to have certain privileges.

29. Such person at any time during his apprenticeship may, with the permission of the Board of Examiners, attend the Ontario School of Practical Science, or any school, college, or university, the course of study in which is, in the opinion of the Board, sufficiently similar to that in the Ontario School of Practical Science, for the purpose of taking any course of study which includes any subjects required for the final examination for admission to practise as a land surveyor, but the total period of such apprenticeship, and of such course of study, shall not exceed the period of two years from the date of the articles of apprenticeship as above mentioned, and not less than twelve months of the said period of two years shall be passed in the actual service of a practising Ontario Land Surveyor. 60 V. c. 27, s. 7 (2).

Attendance at certain Schools during apprenticeship.

30. If a surveyor dies or leaves the Province, or is suspended or dismissed, or ceases to practise, his apprenticeship may complete his term of apprenticeship, under an instrument in writing as aforesaid, with any registered

If Surveyor dies, etc., service may be completed with another Surveyor.

surveyor in actual practice. R. S. O. 1887, c. 152, s. 15. 60 V. c. 27, s. 8.

Instruments
of Apprenticeship
may be
transferred.

31. A surveyor may, by an instrument in writing, transfer an apprentice, with his own consent, to another registered surveyor in actual practice, with whom he may serve the remainder of the term of his apprenticeship. R.S.O. 1887, c. 152, s. 16. 60 V. c. 27, s. 9.

Instruments
binding to Ser-
vice to be filed,
etc.

32. No instrument in writing under which an applicant for admission to practise as a surveyor claims to have served with some practising surveyor for the required period shall avail to authorize the admission of an applicant, unless the instrument has been transmitted to the Secretary of the Board within two months next after the date thereof, nor unless the fee in respect thereof mentioned in section 39 of this Act was by the apprentice paid to the Secretary of the Board at the time of transmitting the indenture or articles; and the said Secretary shall acknowledge by post the receipt of all such instruments or copies thereof transmitted to him, and shall carefully keep the same filed in his office. R. S. O. 1887, c. 152, s. 17. 60 V. c. 27, s. 10.

ADMISSION OF CANDIDATES.

Notice of ex-
amination to be
given by candi-
dates for ad-
mission.

33. Every person desiring to be examined by the Board as to his qualification to be admitted as a land surveyor, shall give notice thereof in writing to the Secretary of the Board, at least one month previous to the meeting thereof. R. S. O. 1887, c. 152, s. 18.

The Board to
require certifi-
cates of good
conduct, etc.

34. Every person applying for admission to practise as a land surveyor shall produce to the Board satisfactory certificates as to character for probity and sobriety, and before a certificate is granted shall perform such practical operations in the presence of the Board, and shall answer such questions on oath (which oath any member of the Board may administer) with regard to the actual practice of such applicant in the field, and with regard to his surveying instruments, as the said Board may require. R.S.O. 1887, c. 152, s. 19.

* * * * *

FEES.

39. The following fees shall be paid to the Secretary-Tariff of fees.
Treasurer for the use of the association :

1. By every person duly authorized to practise as a land surveyor under the provisions of this Act on applying for registration under this Act, the sum of \$1.00.

2. By each member of this association an annual membership fee of \$4.00.

3. By each apprentice at the transmitting to the secretary the indenture or articles of such apprenticeship, \$10.00; 62 Vic. 2., c. 11, s. 18.

4. By each candidate for examination, with his notice thereof, for receiving and entering such notice, \$1;

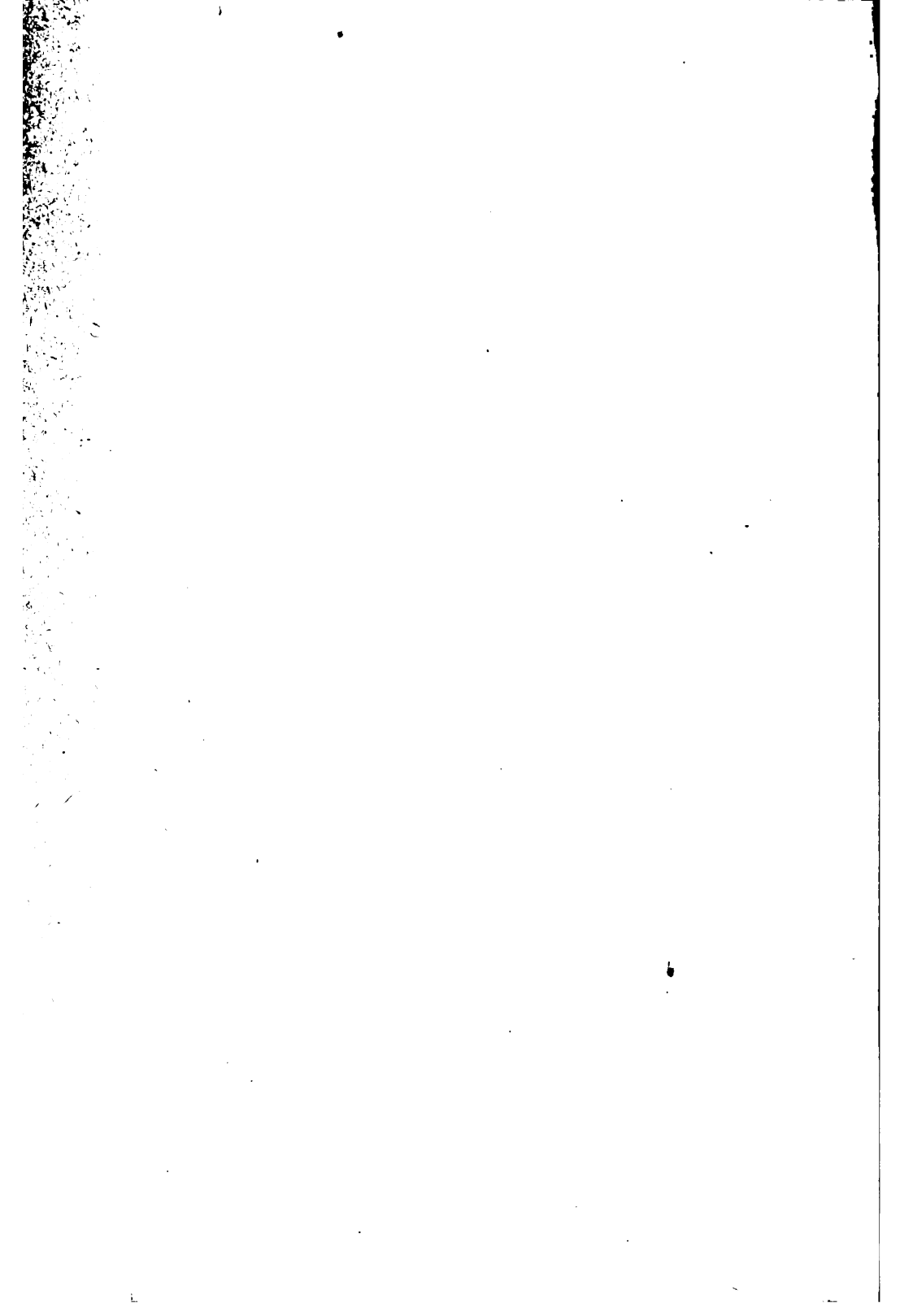
5. By each applicant obtaining a certificate, as a fee thereon, \$2;

6. By each applicant receiving a certificate to practise, as an admission fee, \$30;

7. By each apprentice with each transfer of articles as a fee for registering same, \$2;

8. By each applicant receiving a certificate to practise, being the fee for official notice in the *Ontario Gazette*, \$.

55 V. c. 34, s. 7; 69 V. c. 27, s. 26.



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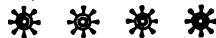
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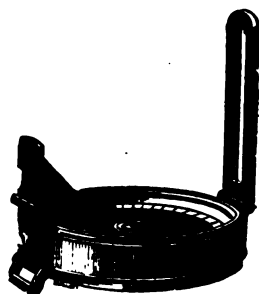
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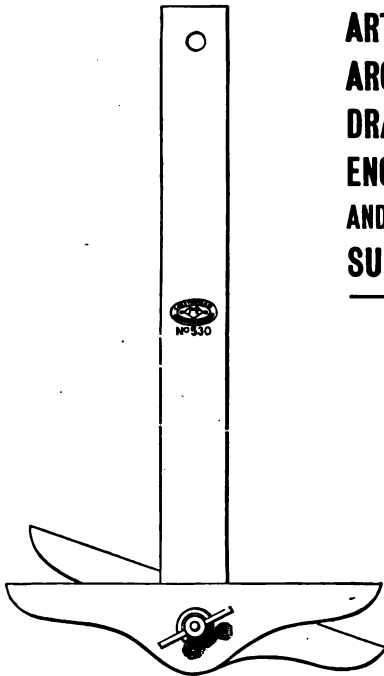
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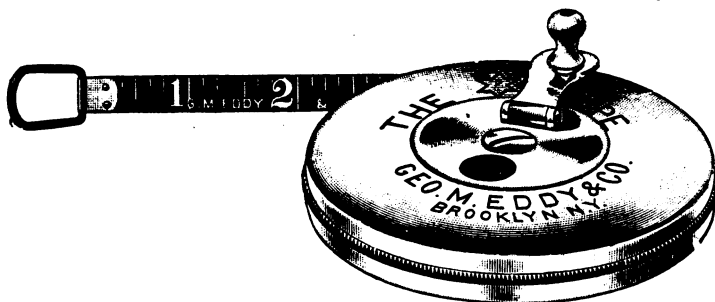
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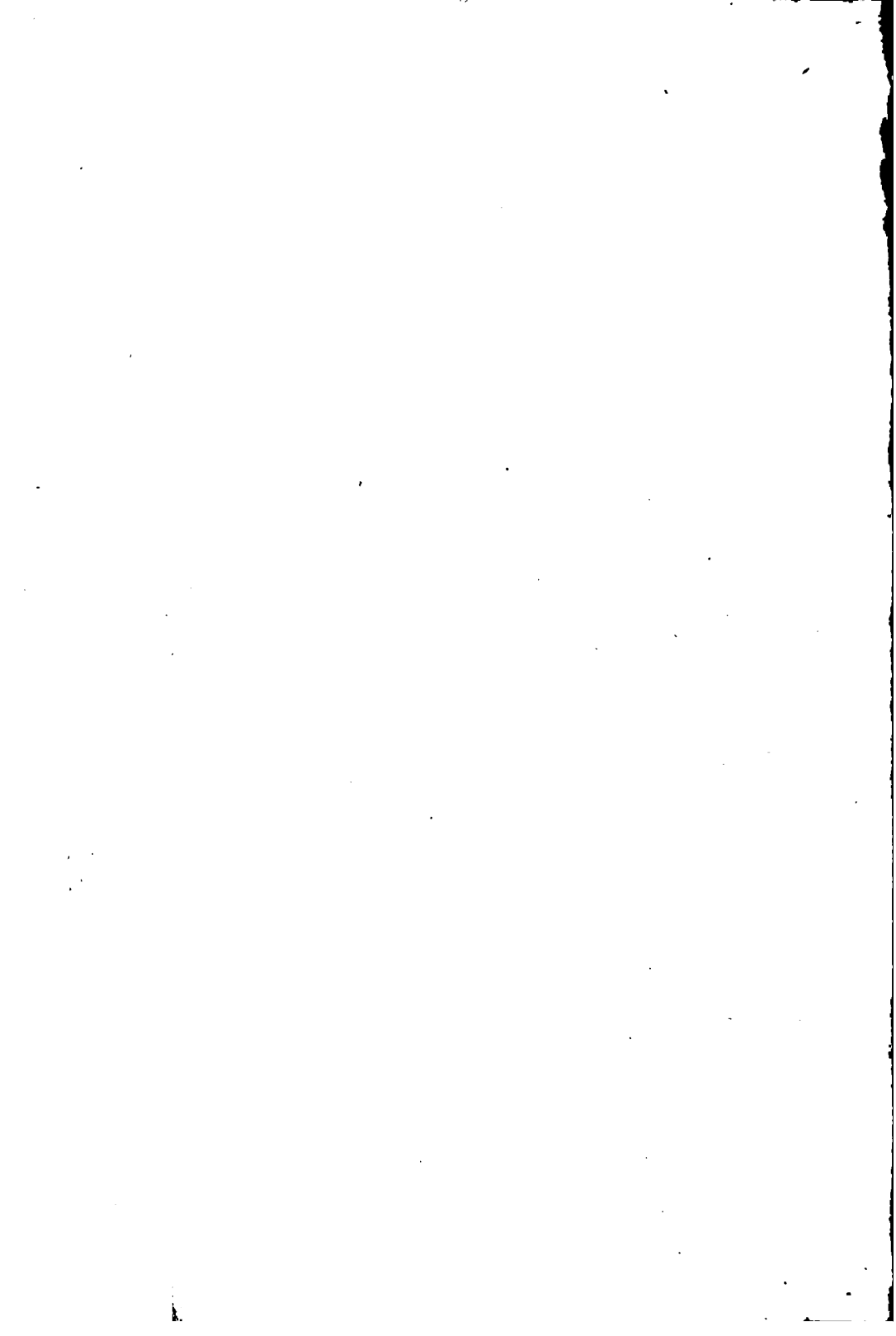


This Valve has been thoroughly tested under low tank pressure to 80 lbs. Send for circulars.

Connect Direct with Main or Tank.

Agent for Canada,

JAMES HARRIS,
71 King Street West, Toronto.



Acknowledgment

THE Association cheerfully acknowledges the receipt of advertisements from the persons and firms whose names appear below, and desires the careful consideration of these advertisements by all who read the Proceedings.

The firms are reliable and deserving of patronage.



List of Advertisements

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James Foster.....	ii.
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The Dominion Bridge Co.....	iv.
The Art Metropole.....	v.
C. Tarling & Co.....	vi.
Henderson & Co.....	vii.
Geo. M. Eddy & Co.....	viii.
"The Engineering News".....	viii.
The School of Practical Science.....	ix.
Expanded Metal.....	x.
Keuffel & Co.....	Second page cover.
W. & L. E. Gurley.....	Fourth page cover.

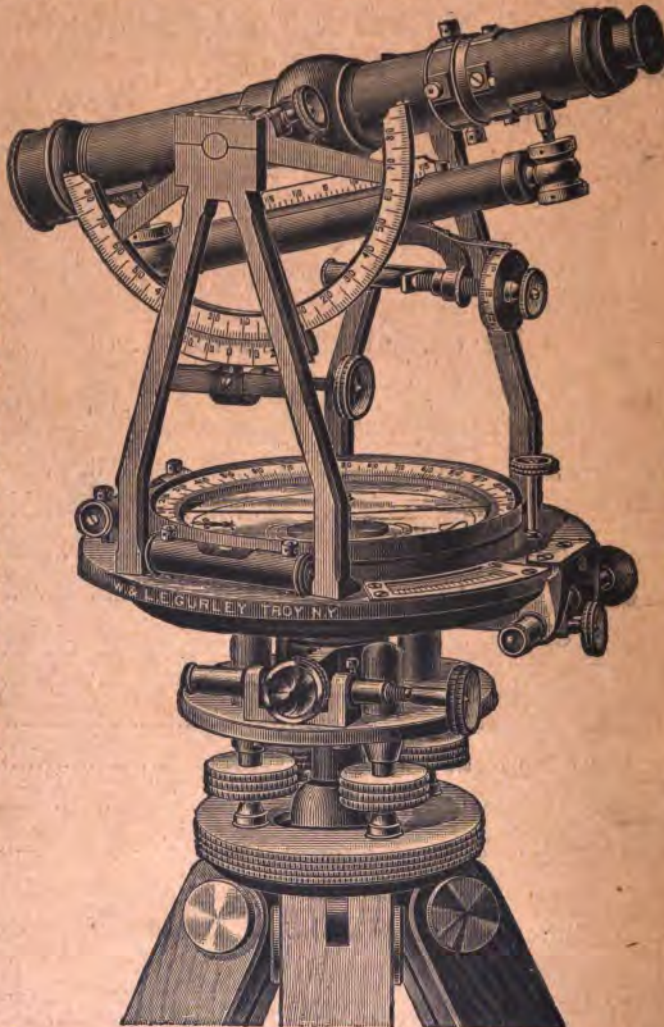
Established 1845.

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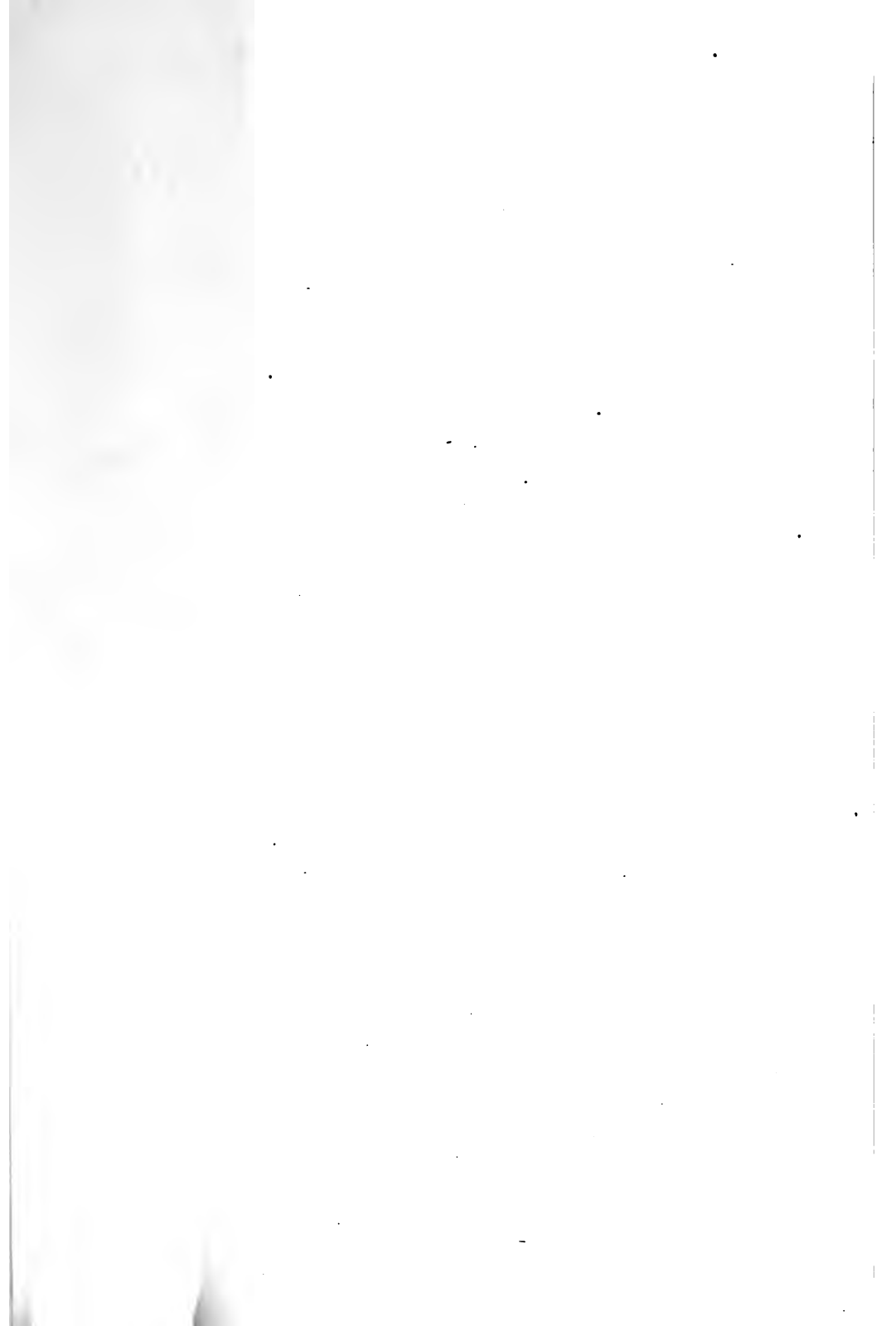
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